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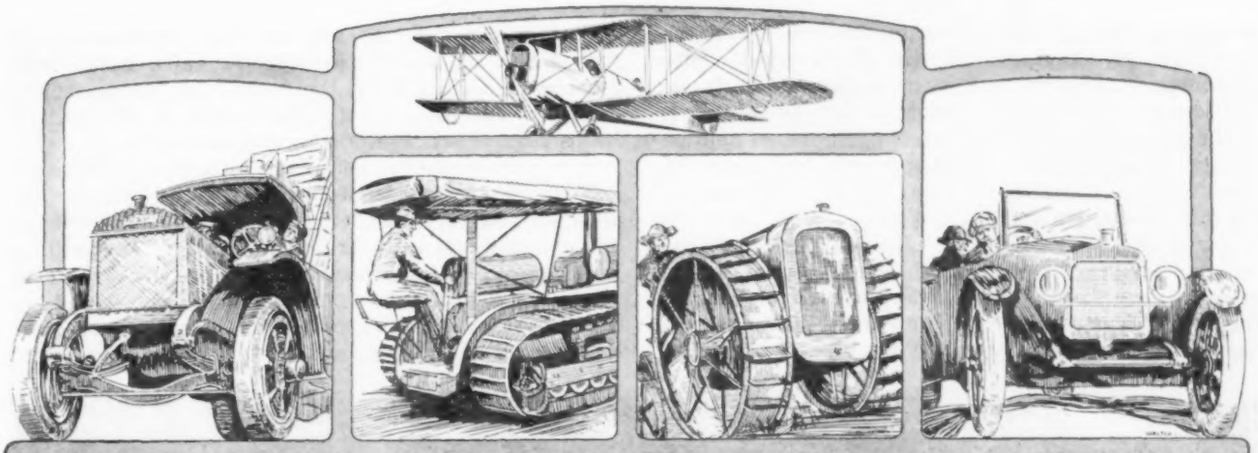

AUTOMOTIVE CONSTRUCTION

Welding Operations on Liberty Motor Cylinders

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The welding problems here outlined and the experience with the various methods and different apparatus, cannot fail to be of value to all who use, or who contemplate using, similar welding methods. The fixtures shown in this article are also suggestive and should prove very helpful in other lines of work.

WHEN the Lincoln Motor Co. began the welding of cylinders, their equipment consisted of two 300-lb. Davis-Bournonville generators with a capacity of 600 cu.ft. per hour, and one battery of ten 200-cu.ft. oxygen cylinders. This equipment was placed in the rear of the main building and was connected by pipes to the welding department. After six months of increasing production, they found that their generating plant was overloaded, and as this was their only method of welding, they decided to build a large generator house, capable of producing gas for completely welding 1000 cylinders per day.

The generator house consisted of a large brick building divided into four compartments: Generator, oxygen, oxygen storage, and carbide storage rooms. The generator room was equipped with twelve 300-lb. Davis-Bournonville generators with a capacity of 3600 cu.ft. per hour, making what is considered the largest equipment of generators in the world. This is shown in Fig. 1. The 12 generators are divided into four batteries of three each. Each battery is equipped with a washer, this being a tank so arranged that the gas passes through 4 ft. of water which removes the solid particles. The batteries are connected by a manifold which is so constructed that it is possible to cut off certain batteries when they are disabled, without affecting the feed pipes.

There are four 1½-in. main feed pipes that transmit the gas from the generator house to the welding department where another manifold was placed to bypass a defective feed pipe should there be any. From this point the gas is piped into units of 48 stations, each station being equipped with a Davis-Bournonville regulator to equalize the pressure.

The oxygen is received in cylinders containing 200 cu.ft. at 1800 lb. pressure. They are then connected in two batteries of 20 cylinders each by manifolds. The oxygen room is shown in Fig. 2. They are so connected that should one battery give out the other would furnish the necessary supply. Each manifold is equipped with a Davis-Bournonville high-pressure regulator which reduces the pressure to 30 lb. The oxygen is then conveyed to the welding department through two 1½-in. feed pipes in a similar manner to the gas.

The first serious trouble was experienced with the torch equipment. The nature of the trouble was severe backfiring, sometimes running back as far as the regulator. After a thorough investigation it was found that this was due to careless operators extinguishing their torches without turning off the gas and oxygen. It is obvious that the oxygen, being of the higher pressure, would then back up into the gas line and cause a very explosive mixture.

As this situation involved the personal element, it was decided to devise a filter as a safeguard against the backfiring reaching the main feed pipes. This filter consisted of a barrel of about ½ in. inside diameter and 2 in. long. Each end was supplied with a cap which was threaded to complete the line from the regulator to the torch-hose connection. The barrel was fitted with a piece of fine wire gauze at each end and filled with fine aluminum shavings. This contrivance would tend to filter the gas or oxygen and would not allow any backfire to pass through it and, therefore,

AUTOMOTIVE CONSTRUCTION

protecting the regulator and lines from disintegration. The torch equipment consisted of Davis-Bournonville torches on heavy work, such as elbows and flanges, and Torchweld on lighter work such as cylinder jackets.

The oxy-acetylene flame has a temperature of approximately 6300 deg. F. When properly produced this flame is small, neutral, neither oxidizing nor carbonizing, and is applied with almost pencil-point concentration. It is in this form of a properly proportioned high-temperature flame that the great success of the process lies. The highest temperature of the best fuel furnaces is about 3000 deg. F., and of the oxy-hydrogen flame, something less than 4000 deg. F.

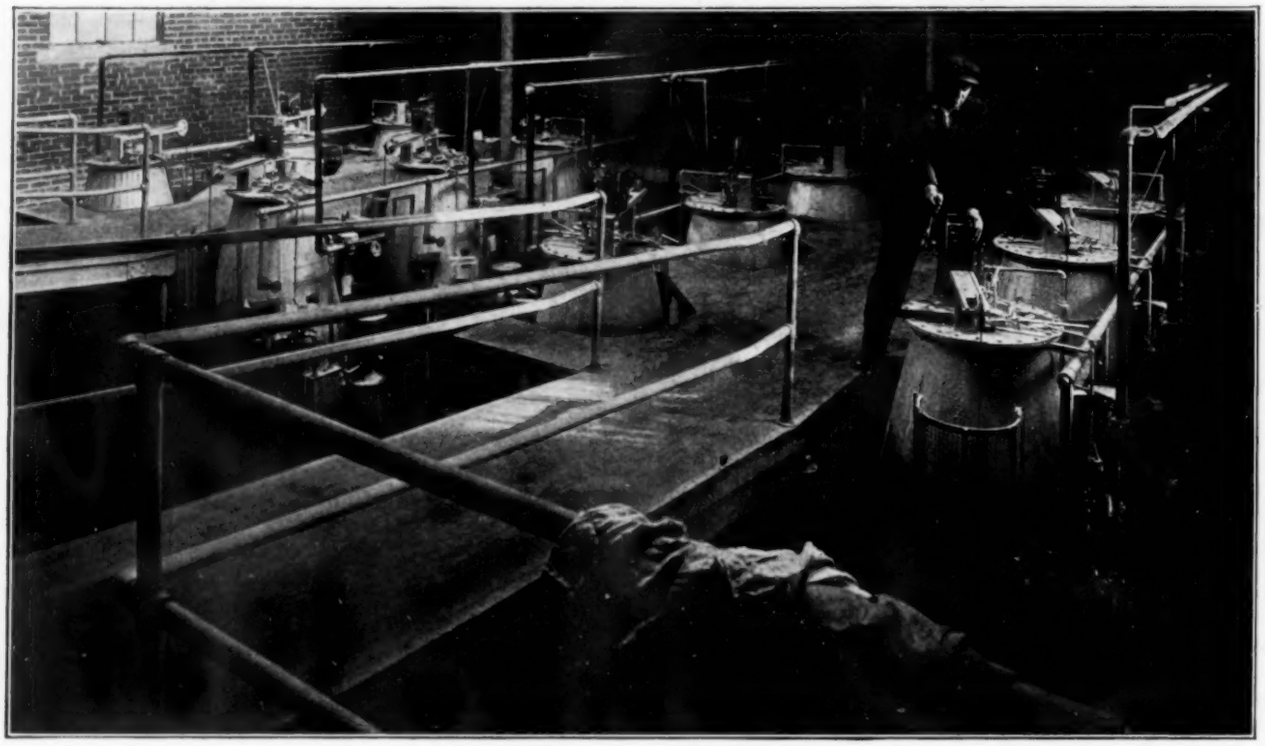


FIG. 1. THE GAS GENERATOR ROOM

In the ear'y stages of the welding, the cylinder was assembled to the exhaust and intake elbows on a large pilot fixture, Fig. 3. The fixture consisted of a pilot with a head to fit the curvature of the dome. The head was equipped with hand screws for securely fastening the elbows in place after being located. A pair of clamps, operated by a cam and equalizing arrangement, was fastened to the base for exerting an extreme downward pressure upon the flange and thus holding the dome against distortion. This method of holding gave very uncertain results due to the expansion of the metal at the point of welding which would sometimes force the elbow to creep ahead of the welding torch; and also the heat from the highly radiated head of the welding torch progressing circularly down the cylinder dome and walls had a tendency to drop and distort the dome.

Then they removed the clamps and pilot from the fixture and slightly decreased the radius on the head. This, when assembled, had a tendency to decrease the radius of the dome by the extreme pressure applied with the hand screws through the valve guide holes forcing the head against the dome. In this manner of assembly, the elbows were first tacked to the cylinder by an electric arc, Fig. 4, and then welded by gas. The results were somewhat better but distortion still existed.

They next proceeded to heat-treat the cylinder but with no better results. It was then thought probable that placing the cylinder in water up to the welding portion, consequently keeping it cool, would tend to eliminate distortion. It is obvious that when this method is employed, it necessitates the use of more heat, more careful handling, and due to the rapid cooling, does not give a homogeneous weld. This idea was then abandoned and the cylinders were welded and afterward placed into a vat of warm water for rapid cooling, which helped to subdue a portion of our trouble.

The next development was to purchase a 6-arc close-circuit welder from the Arc Welding Machine Co. This consists of a motor generator and regulator set with an exciter. The exciter is a small motor-generator set which furnishes the current to excite the fields of the regulator. The regulator controls the current and voltage which is furnished by the generator to satisfy the number of arcs being used. Each arc is cut in use by an automatic relay, which was inefficient because of the fact that should an operator break his arc too quickly the relay would not respond, the line would be open, and all other operators would lose their arcs.

The direct-current electric arc is essentially unstable. It consists of a series of pulsations. If each pulsation be divided into several units, some of the units will show a very strong exposure while the rest will steadily

AUTOMOTIVE CONSTRUCTION

die down until only the slightest trace of the arc can be seen. It invariably requires a higher electromotive force to start the arc than is thereafter required to maintain it; therefore, if there is the slightest irregularity in the current, the arc will probably be broken.

In carrying out the process of welding, the work is connected to the positive pole while the electrode is connected to the negative. The arc, which is struck between the work and the electrode, is in reality a miniature electric furnace with a temperature estimated

FIG. 2. WHERE THE CONTAINERS ARE FILLED

at 9000 deg. F. The intense, but highly localized heat of the arc, melts the electrode as well as a portion of the work. The molten electrode is deposited on the work where, if properly controlled, it mingles with that portion of the work which has been melted, forming a perfectly homogeneous joint.

Preventing Distortion

So the Lincoln Motor Co. carried on, for a small period, experimental production of arc welding the cylinder. This eliminated the dome falling and other distortion, but due to the fact that the human element was involved and the breaking of the arc for the reasons given, it was almost impossible to produce a cylinder which would not leak in the weld. The leaks could not be repaired by the arc unless the previous weld was chipped off, which made the first a very inefficient operation. If repaired by the gas, the metal would be porous, so they decided arc welding was much more inefficient than the torch method.

In the meantime, it was learned that the Nordyke-Marmon Co. were arc welding both elbows three-fourths of the way around and the balance, which is the section between the two elbows in the center of the dome, with an acetylene torch. It seems, according to their data, that the dome sunk in arc welding in reciprocal ratio in relation to the amount of expansion that took place when gas welding the balance, thus bringing the dome back to its original position. As the equipment at the Lincoln plant did not allow them to employ this process, it was not tried out.

The next development was building the fixture that would accurately locate the assembled cylinder and elbows for tacking and thus eliminate this uncertain, inefficient process of setting them upon a pilot and surface plate, which had been heretofore employed. The fixture consisted of a cast-iron ribbed framework surrounding the cylinder with an expanding pilot for centrally locating the cylinder. A hinged plate at the bottom of the fixture located the flat on the cylinder bolt flange, which is parallel to the portholes, and the latter in turn are parallel to the elbow locating plugs. Two of these plugs, which enter into the valve guide holes, are located on a hinged gate which is closed after the cylinders and elbows are placed into the fixtures. The two plugs are then forced into the valve guide holes together with the plugs locating the portholes situated on the sides of the fixture. Inasmuch as this operation and all future operations of the cylinder depend on the proper alignment of the elbows with the flat on the bolt flange, it is absolutely necessary that all burrs on the locating portions be removed.

Using Revolving Fixtures

These fixtures are placed in pairs on a revolving stand, Fig. 5, so situated that one of the fixtures is inside the welding booth being tacked while the other is outside being set up. After tacking, the cylinder is removed and inspected for the alignment of the elbows. In this operation, the cylinder is placed on a fixture which consists of a pilot mounted parallel on a surface

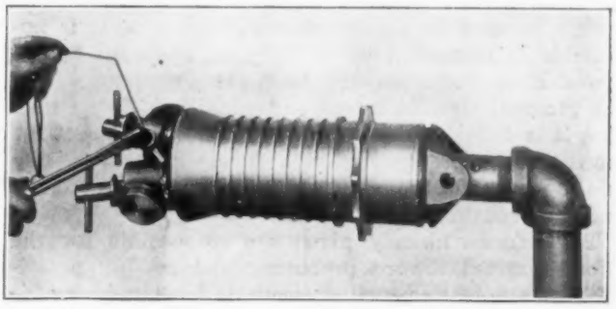


FIG. 3. TORCH-WELDING THE ELBOWS

plate with a dial indicator arrangement for locating the flat. Arbors are placed in the valve guide pin holes and a reading taken with a Brown & Sharpe dial indicator. If this reading is within the limits specified, the cylinder is passed on for welding. If not, the tacks are broken and the cylinder reset and tacked again.

In arc welding, the last development in endeavoring to overcome the distortion caused by the heat is shown in Fig. 6. This consists of two ½-in. capscrews, a ¾-in. capscrew and a 1-in. plug. The top of the plug has the same radius as the top of the dome and was inserted in the center of the head. The two ½-in. capscrews were screwed into the head through the spark-plug holes so as to relieve part of the entire strain from the hand screws. The ¾-in. capscrew was placed on the under side of the head so that when it was tightened it would exert a pressure against the top of the dome. Even with this fixture in place the elbows had a tendency to creep and distort, the domes dropped, and we were confronted with either re-machining or heating the domes to restore them to their original position.

AUTOMOTIVE CONSTRUCTION

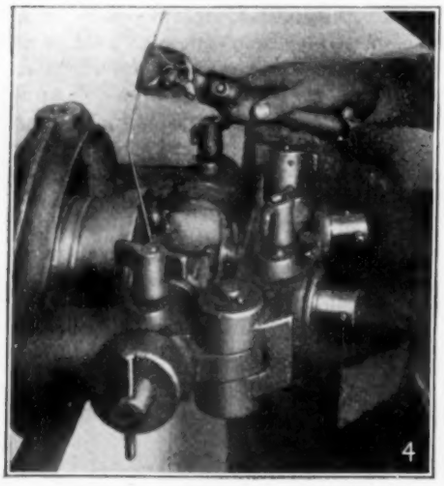


FIG. 4. THE FIXTURE FOR HOLDING THE ELBOWS.

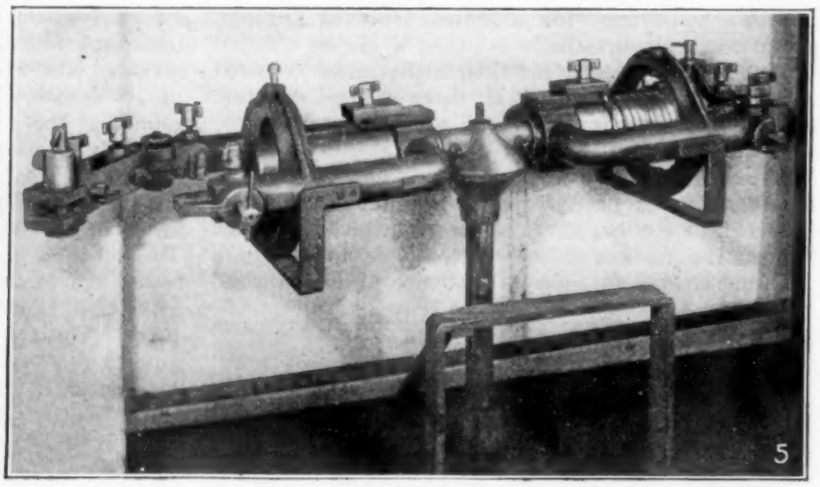


FIG. 5. A DOUBLE FIXTURE FOR HOLDING THE ELBOWS

The process of arc welding had up to this time, been applied manually only. The operator brings the end of the negative electrode into contact with the positive work, starting the flow of current, then slightly separating them to form the arc, and hereafter maintains the arc by gradually bringing the wire toward the work as fast as the former is melted. The temperature of the arc being exactly proportionate to its length, variation in the length results in a lack of uniformity in the weld. Because the arc is inherently unstable, it is impossible in manual welding, for even the most skilled operator to keep the arc length constant. In fact the personal element enters so largely into the process that it is difficult to even maintain the arc constant for more than a few seconds at a time. Short-circuiting of the wire upon the work results in burning the metal and thus causing a weak spot in the weld.

The reasons already given are responsible for the efforts exerted toward producing and making practicable an automatic pencil or electrode feeding device for use on elbow welding. The first effort concentrated the solenoid idea of holding the length of the arc. Experimental work was carried out on a lathe whose spindle rotated once in 45 seconds. A center fixture was built to rotate the cylinder between centers so that the welding portion between the cylinder and elbow would rotate from the axis between centers. A small direct-current motor fixture was placed so that the electrode was fed upon the work to be welded at a 30-deg. angle. The speed of the motor regulated the feed of the electrode.

The electrode never melts uniformly, as there are hard and soft spots in the wire, and so it was necessary to control the speed of the motor by the arc and that was done in the following manner: Several grids of resistance were cut in series with the motor. Each grid was connected by a bypass which was closed and opened by relays, these being operated by a solenoid that was cut in series with the arc. The same trouble existed as in the direct-current hand arc. There were several leaks which were almost impossible to repair due to the burning of the metal.

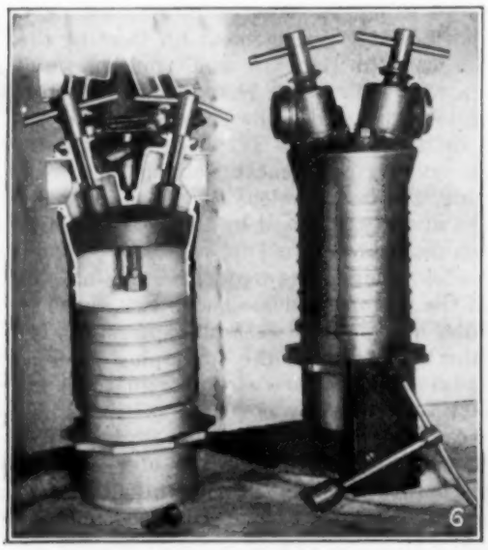


FIG. 6. THE FIXTURE FOR HOLDING CYLINDER CROWN.

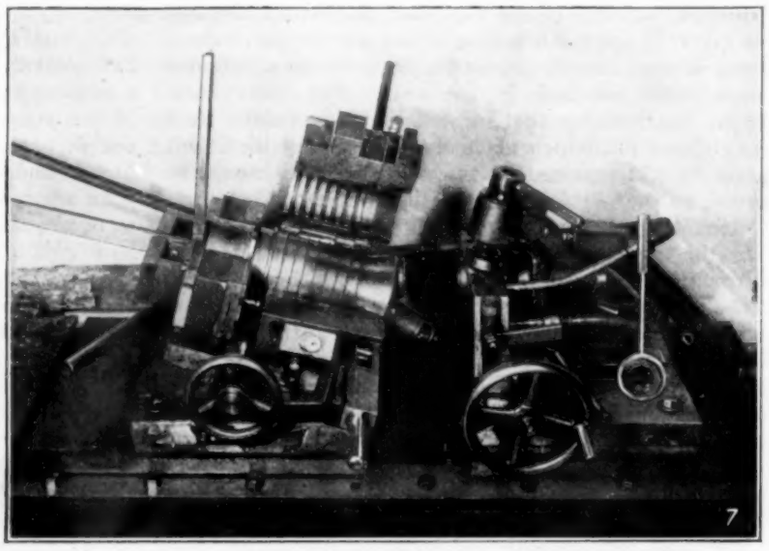


FIG. 7. THE BUTT-WELDING FIXTURE

AUTOMOTIVE CONSTRUCTION

After further investigation, it was found that the Arc Welding Machine Co. had produced an automatic pencil feeding device. The motor speed was produced and regulated by the exciter and regulator of their welder. This was given several tests but the leaks still existed so this method was never put into operation.

The Lincoln company next investigated the butt welder, which is becoming more and more practical daily. Previous to the time of this investigation the Ford Motor Co. had succeeded in producing a butt welder for welding the semi-finished elbows to the cylinder, re-machining them afterward. The adoption of this plan would have caused delay and would have necessitated so much additional equipment that it was considered impractical for them and they experimented with butt welding the finished elbow to the finished cylinder. This experimental work was carried out on a Thomson butt welder for which there was developed an experimental fixture to carry out the ideas in mind.

They then designed and built a more elaborate fixture, Fig. 7, of Tobin bronze with which they were able to weld at the rate of 25 cylinders per hour, having 1 per cent. leaks and without any distortion. Fig. 8 shows the machine in operation. The elbows and cylinders necessitated a slight change at the point of welding. The nature of the change was to allow $\frac{3}{16}$ in. of extra stock on both, for a flash and weld. After welding, this was chipped off of the outside with an air hammer while in a holding fixture and reamed from the inside with a special inserted-blade shell reamer. A 24-in. Cincinnati drilling machine was used with a swinging fixture that indexed in the valve guide hole. This method gave complete success and they were about to install four additional welders when demand for production suddenly came to an end.

They also devised a fixture for salvaging cylinders which were distorted out of the limits by heat. This was a heavy cast-iron die with hardened-steel bushings and plugs. When the cylinder was in place and the plugs inserted, the cylinder and elbows would conform to the specified print dimensions. If the cylinder was off square or off angle, it was placed in the fixture and heated with acetylene torches, and the locating plugs inserted forcing the elbows back into position.

After welding, the welds were hammered with a 1-lb. peen hammer, to remove the scale and loosen any poor welding, so that any leaks would show up in the water test. The cylinder was then inspected.

The water jackets are then fitted to the cylinder, and the latter when assembled, is placed in a clamping fixture, Fig. 9. This fixture consists of a frame with two jaws which are placed around the jacket for holding while being tacked. The equipment used in this operation is a miniature-style Torchweld torch, equipped with a No. 3 tip and $\frac{3}{32}$-in. Norway welding wire.

After being tacked, the cylinder is placed in another fixture, and the bottom of the jackets are welded to the jacket flange on the cylinder. The fixture employed in this operation is a fork made of steel 1½ in. wide, so shaped as to fit the top of the cylinder and thus keeping it in an inserted position. Welding the bottom first was considered to be an advantage as the heat applied at that point had a tendency to draw the jackets closer together. It was also considered advisable to leave an opening between the jacket halves of about $\frac{1}{16}$ in. to $\frac{3}{32}$ in. to take care of the contraction which the different jacket-welding operations tended to produce.

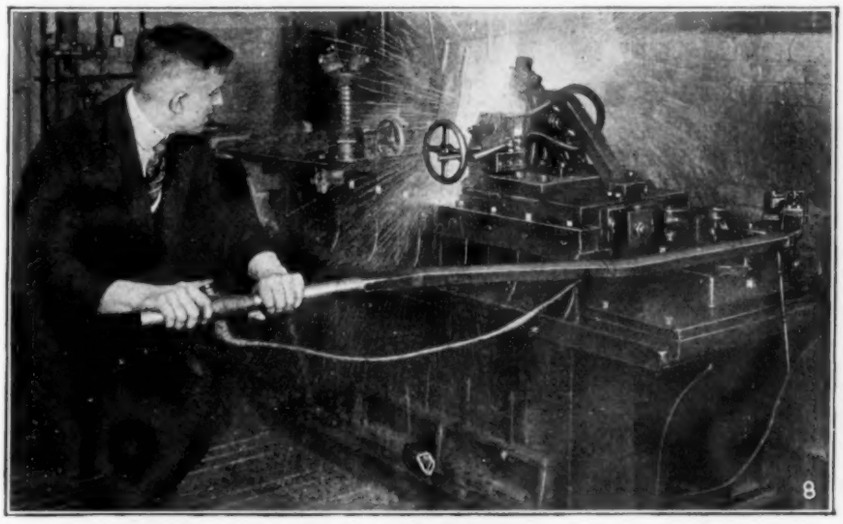


FIG. 8. A WELDING DEVICE IN OPERATION

FIG. 9. TACKING THE JACKET

The cylinder was next placed in a horizontal position on a cast-iron table, and the jacket-side seams were welded. The welds were started from the bottom proceeding upward to the portholes. The cylinder was then placed in an upright position and the top seam completed. The equipment used in this operation was a miniature Torchweld torch equipped with a No. 2 tip and $\frac{1}{16}$-in. Norway welding wire.

The next operation was to weld the jacket around the two spark plugs, valve guide and camshaft housing bosses. The fixture employed in this operation carries a pilot upon which the cylinder can be turned circularly. The equipment used is the same as before except that a No. 3 tip was found best.

AUTOMOTIVE CONSTRUCTION

Next came the welding of the jacket around the porthole flange. The fixture used in this operation consists of a standard with a revolving cradle to lay the cylinder in. The revolving motion of the cradle, together with the varying height of the standards, gives the operator easy access to weld. The equipment used is a No. 1 Torchweld torch equipped with a No. 3 tip and $\frac{1}{16}$-in. Norway welding wire.

The next operation consists of welding both water pipes to the jacket and the jacket seams between the valve guide and porthole flanges. This is shown in Figs. 10 and 11, both inlet and outlet being handled in the same fixture. This fixture is equipped with two devices for holding the water pipes in their proper position while being welded and is so arranged that it can be oscillated to suit the position in which the operator is welding. The cylinder is located by a flat clamp which locates the flat on the cylinder bolt flange in proper relation to the pipe-holding devices.

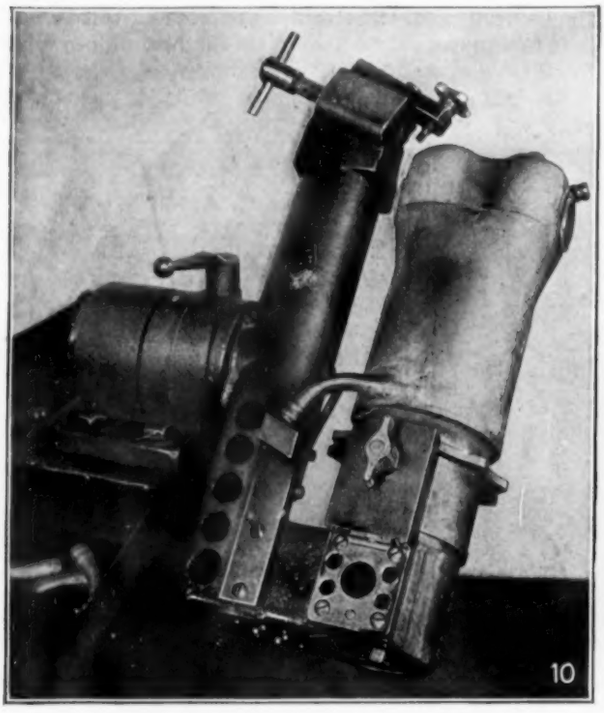


FIG. 10. WELDING THE INLET PIPE

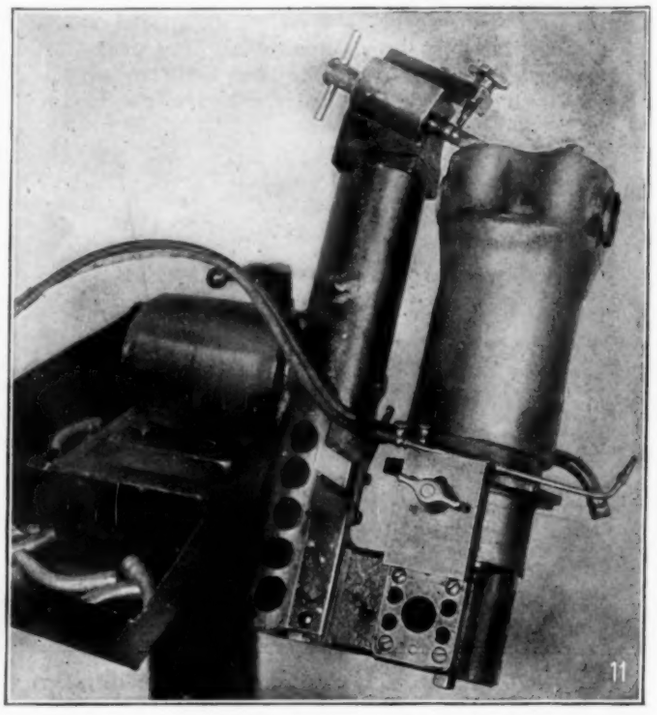


FIG. 11. WELDING THE OUTLET PIPE

The jackets seams are welded first, followed by the water outlet pipe. In these two cases, the cylinder is welded in an upright position. The locating clamp on the bolt flange flat is then released and the cylinder given a half-turn to the opposite flat. The inlet pipe is then placed in its holding device and welded with the fixture in a semi-horizontal position to suit the welder.

The cylinder is then removed and the water pipes inspected for proper location. If it is passed, the cylinder is hammered with a rawhide hammer to remove scale and loosen any poor weld, after which it is tested for leaks. If leaks are found, they are repaired by expert welders and returned for re-inspection.

The next operation consists of assembling the flanges to the cylinder. This operation employs two fixtures, shown in Figs. 12 and 13. These are placed on a revolving stand that is operated similar to the elbow tacking fixture. The fixture consists of an expanding pilot for holding the cylinder control, and a stop for locating the flat on the bolt flange. A bridge is built over the pilot with a yoke and two clamps to locate the flange. The cylinder is slipped on the fixture far enough for the yoke to square up the flange. The pilot is then expanded and the clamps tightened up, drawing the flange to its proper position. It is then tacked by the electric arc.

The electric arc used for tacking was produced by a motor-generator set of the Lincoln company's own make. The generators were rewound and their normal speed reduced so as to make them produce a low voltage and high amperage. The current was then passed through a rheostat which was made up of a series of cast-iron grids of resistance. This gave the necessary supply of current for each arc, which was generally 30 volts and 110 amperes.

After the flange was tacked on the cylinder, it was then welded. The first experience was welding them with oxy-acetylene gas. This proved very inefficient and slow, and necessitated the employment of a good many welders. They then experimented, using the direct-current arc and found it doubled the production per welder. As the arc was cheaper, it was decided to investigate the different types of welding outfits for the purpose of adding additional equipment to arc weld the entire flange production.

It is obvious that in direct-current welding, a power plant is necessary, which requires a heavy motor-generator set and an elaborate switchboard, the whole set weighing about 2000 to 3000 lb. The secret of holding

AUTOMOTIVE CONSTRUCTION

and controlling an alternating-current arc has heretofore been long experimented on. The device of the Electric Arc Cutting and Welding Co. proved of light weight and practical, consisting of a special type transformer without any moving parts.

It is one of nature's laws that the heat in the arc is the product of both the current and the voltage across it, which is identical with the energy. An experienced operator can weld from almost any source of direct-current power supply if he is provided with the means

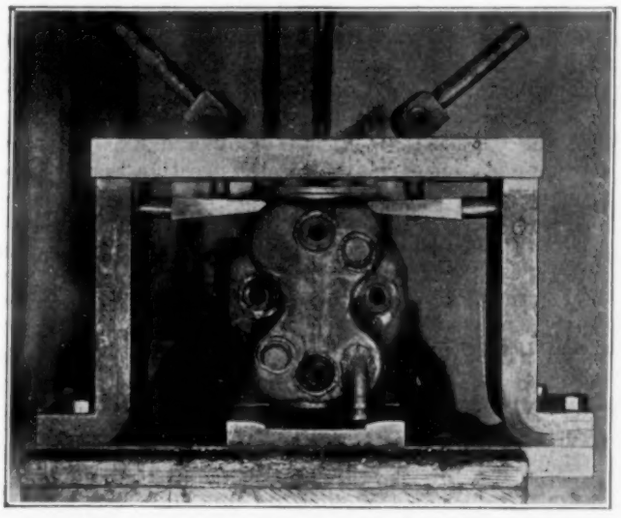


FIG. 12. END OF THE FLANGE-WELDING FIXTURE

of holding the current substantially uniform which is a very difficult proposition. The variety of arc lengths which the direct-current machine makes it possible to hold, often makes the operator careless, so that he burns the metal and causes leaks and crystallization.

The alternating-current machine holds this arc wattage and heat substantially constant for any given setting, which is necessary for different classes of work and electrodes. The arc length must be held almost uniform, as any variation will cause it to break. As soon as any person becomes accustomed to the sound and sight of the arc and can deposit the molten metal where he desires, it is inexcusable to burn the metal

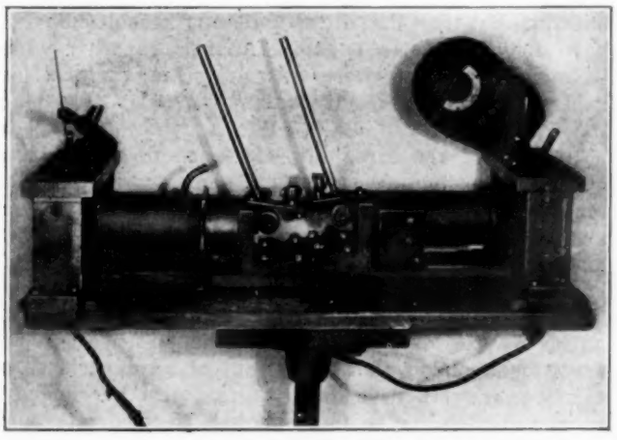


FIG. 13. DOUBLE FIXTURE IN USE

from too much heat or to make imperfectly joined, or "cold shot" welds from too little heat. Different metals, electrodes and conditions in the welding department require various amounts of heat and varying temperatures. These adjustments are obtained by a handle which adjusts a laminated core in the transformer induction circuit. There are several taps arranged on a plugging board that cut various windings in the transformer secondary winding. The transformer is cooled by a fan.

The transformer is approximately 85 per cent. efficient whereas the direct-current motor-generator sets vary from 5 per cent. to 60 per cent. efficient. It deposits metal at about 5c. a lb., which is very much cheaper than the direct-current or gas. The 60-cycle type of alternating-current machine weighs about 200 lb. and is equipped with handles so that it may be carried to any location, set on a bench and be ready for use. Another good feature of the alternating-current arc is the deposition of the metal with a smoother surface than with the direct-current arc.

After investigating these features thoroughly, 10 of these machines were purchased and it was found that they increased production from 36 to 80 cylinders per man, per nine-hour day. The best results were obtained by using a $\frac{1}{8}$-in. flux-covered wire for an electrode, several different kinds of flux being used. Some very important experiments were carried on, using boron sub-oxide and titanium, magnesium and sodium silicate, the latter giving the best results for various kinds of wire. It was found necessary to put round disks of sheet asbestos in the portholes to obstruct the iron oxide from sticking inside the valve cages. Cylinders were then sent to be tested for final leakage inspection.

The Cost Department of the Future

BY ENTROPY

Should the cost department be a part of the machinery of production or should it be a sort of detective branch to stand off at a distance and criticise?

To the question put in this way there can be but one answer. Every part of the organization should pull together toward one common end. Every part must think in one direction and that is toward the greatest possible production with the least effort. Any part of the organization which is putting on the brakes and slowing up for imaginary obstacles is a money loser.

If the cost department puts itself in a critical attitude it antagonizes the profit-making function of the business, upsets the minds of the persons criticised and puts itself in such position that its recommendations are not well received. If it will instead make itself into an interrogation point and inquire as to why costs in a certain department for a certain operation took a jump, it may find there was good reason for the increase.

The production department should produce and do nothing else. The cost department should find out what is being done by the production department without disturbing the latter in any way. It should not ask a production foreman to make a single entry on a scrap of paper for its benefit, nor ask a producing workman to step to one side to let a clerk pass by. It should be

self-effacing but persistent in its search for facts. The cost department's own men should count and check parts made and operations performed.

To be sure if it does all these things and the work is charged against it instead of being absorbed in the total overhead charges the management may discover that cost-keeping is more expensive than they thought it was, but it is better to face things as they are than to deceive oneself by charging the cost of one thing against another just because that other can stand the charge better. Too often the cost department spends the greater part of its time playing solitaire with overhead charges, and too little on actual day by day and operation by operation, costs of manufacture. It is not enough to know that in a given room with a large number of operatives the total cost of making so many thousand pieces was so much. The valuable thing is to know which is the operative that makes the most money for the firm; who it is that uses the least material, oil, waste, etc., and at the same time turns out the most work per dollar of total expense; if all the profit in a room with a hundred operators is made by ten why not dispense with the other ninety. In other words cost-keeping is not altogether a matter of total costs but has to do with the individual work of the employees. The cost of keeping these individual records is large but unless they are so kept an opportunity for profit is overlooked and meritorious cases can only come to light through observations of the foreman.

The Worker and the Foreman

Foremen have their own personal comfort to look out for and it is natural for them to hold the good money makers back rather than help them to promotion. A good worker is a great help to a foreman. Good workers are apt to be promoted if the management knows about it, and if they are, the foreman does not get the benefit of their services, consequently foremen are much inclined to smother budding ambitions. A cost system which brings out not merely average costs but the high and low individual costs will bring out possibilities that otherwise might easily become lost in the shuffle.

Cost work is research into both the financial and the productive side of the business. It should enable the superintendent of production to tell whether or not a contemplated change is going to add so much to the overhead charges as to be unprofitable. Every change in manufacturing methods should indicate, through the medium of the cost accountant, the direction in which to go when trying the next experiment.

There is need of more expert work in cost-keeping and more expert advice based on the work of these departments. Just as a research engineer in the mechanical, electrical or chemical laboratory tries out things on a small scale, the cost research man must experiment and deduce from the results of his experiments what will happen when it is tried on a larger scale. The cost expert will not allow his firm to buy an expensive machine which is capable of but one operation on one piece, even though it will save nine-tenths of the time spent on that piece, if it is going to stand idle the larger part of the time. He will help his employer to avoid the use of standard machines when, even with their low overhead expense and power consumption, the labor cost of operating them exceeds that of a special machine that would replace a number of them, because he will have the comparative figures with which to demonstrate.

Stated another way, the cost-keeper of the future must be a man who can figure costs beforehand rather than afterward. Almost any one can have hindsight, but if a man wants to become valuable to any concern he needs foresight and to be able to predict from a study of what has gone before, what is likely to happen when one or more elements of a problem are changed.

The Status of the School Shop

By J. B. Phillips
Instructor in Manual Shop Practice, Los Angeles High School

I would like to suggest for discussion in the *American Machinist* a few questions pertaining to the apprenticeship system and its relation (or lack of relation) to the numerous technical and high schools throughout the land, from which many young men more or less familiar with the fundamentals of machine-shop practice are being graduated.

Technical journals and orators constantly asseverate that the "trades" are disappearing and that learning a trade does not carry with it the prestige that it bore a quarter of a century ago. This statement no doubt has reference to the constantly diminishing circle of activity in which the average industrial worker is engaged and is a natural outgrowth of machinery, organization and economic pressure, but the fact remains that the world today is in greater need of good all-round mechanics than ever before, and to meet this need the schools and colleges of America are spending millions of dollars for buildings, equipment and instructors.

Many graduates of such institutions, having spent from one to three hours a day for a number of years in school shops, find ready acceptance as apprentices in regular shops providing they do not press a claim for time allowance. The tendency to do this, however, keeps many a clever lad from taking up shop work, and ultimately works against the best interest of industry, whether it be from the viewpoint of labor or capital.

A few weeks ago a young ex-soldier who has had five years of consistent school shop practice and who could not readily resume his college career where he left off, desired to enter a large railroad shop as an apprentice provided they would give him a reasonable allowance on his time, but this was refused by the foreman who said that they had tried a great many school shop boys and that about all they knew about a lathe was that it had a pair of centers.

The question is, Was the foreman candid in his assertion or was he biased by craft tradition? It is unquestionably true that in establishing school shops we have too frequently engaged instructors who, while technically qualified, were entirely lacking in practical experience, but this condition is now rapidly disappearing.

In view of the foregoing there are three pertinent questions demanding attention, namely: Should the school shop graduate be credited with a time allowance as an apprentice? On what basis should the time allowance and experience be fixed? Who should establish this standard?

In discussing them, we will encounter the natural antipathy exhibited by the regular apprentice and the traditional journeyman which, out of an experience of thirty years, I believe to be the greatest barrier to a proper solution and this we may help to remove through a liberal educational campaign.

Extracts From Chordal's Letters

Many good mechanics who take pride in their work seem to think there is nothing to be gained by making a study of the technical side of their trade or even reading mechanical journals. In this letter Chordal tells how one mechanic derived some benefit and a great deal of satisfaction from the study of a book on a subject in which he was interested. He also gives an amusing account of "passing the buck" in regard to determining the exact time.

Mr. Editor:

* * * Charlie Gay had finished his apprenticeship and was considered a nice workman. He had sharp points on his fingers and did the fine and delicate work in the shop and today he would be classed as a toolmaker. He lived at home and bummed with the boys, and did very little reading, but he found time to do lots of instructive tinkering at home and his father gave him a nice foot lathe and he had accumulated quite a lot of small tools. He would make things without caring much what he made, but everything he made was nice. Sometimes it would be a set of boxwood chessmen, and sometimes it would be a set of napkin rings for his mother, and sometimes it would be the repair of the sewing machine, but in all this work, which was generally done at night, he had no settled plan of producing anything he could be proud of or anything that called for any originality. He was 18 years old.

* * * Now it happened many years ago that Charlie reached his twenty-second year and got married, and his father gave him as a wedding present a very nice house. Charlie moved into the house, and along with him and his wife went the foot lathe, which was installed in an attic room. For a while he did nothing in his upstairs shop till finally he began to think about what he would make next.

* * * One of his wedding presents, given him by one of the boys of the shop, was a little book, one of Weale's Series, called "Clocks, Watches and Bells," by E. B. Dennison. For the first time in his life he read a book through studiously, and then he read it through again and found out all about clocks, and clock gearing, and pendulums, and escapements, and he mastered what little mathematics was involved in the subject. He was thoroughly interested in the book and he about wore the volume out.

* * * And then a notion struck him. Why not build a clock? He would do it. He planned the thing out and decided that he would have a grandfather's clock of his own fabrication. He made drawings of what he proposed, but put no originality into the affair except that the wooden case would be about five feet high, with the clock movement standing on top and a glass case around the movement, so that he could lift off this glass arrangement and have full access to the clock movement back or front. And he put large doors in the back of the main case and in its sides, as well as its front. This required the proposed clock to stand away from the wall, which was a good idea in its way, for it enabled him to inspect its workings freely.

* * * Mary fell in with his scheme and she got the fever and read Dennison's book, and when Charlie started in on the work Mary was able to follow intelligently every one of his movements, for she knew E. B. Dennison's book by heart.

* * * Then Charlie set to work and he put in nights for about a year making the parts of his clock, and he did most everything himself, even the woodwork of the case. He bought pinion wire for the pinions, but he rigged up his lathe to do all of the gear cutting. He made the hands out of sheet metal and blued them and then became dissatisfied with them and made another pair which suited him. The face, or dial, he had silver plated and he stuck on it gold-plated numerals which he got from the patternmaker. The weights were wound up by pulling on chains like a cuckoo clock, and he made a scientific affair out of the pendulum, with all manner of provision for compensation on account of temperature, and he provided the pendulum bob with an open cup into which he could drop or from which he could remove trifling little weights to alter the rate of the pendulum without stopping it.

* * * Finally all was done and the clock was installed in the presence of Mary and his father and mother and sister, who were very proud of this accomplishment and were anxious to know if the clock would actually run. Charlie and Mary felt no anxiety about the matter for they had both so thoroughly absorbed the teachings of E. B. Dennison's book, and Mary had such confidence in Charlie's mechanical skill, that they felt sure about the thing.

* * * The moment came and Charlie swung the pendulum to one side and let her go, and she continued to go for over forty years, and it went about right. Second after second and year after year the pendulum swung and the tick was all right, and inside of six months the clock had been regulated down to a fine point, and there never was a miss in winding the clock.

* * * A baby took a notion to arrive in the house, and that baby's little heart started on its pulsations without a stop until that baby was grown and was married, and there was another baby and the heart of the first baby slipped a cog and ceased to beat, but Charlie's clock ran on.

* * * Notwithstanding there was nothing more to be done about the clock Charlie and Mary read E. B. Dennison's book through again, and as the book was worn out they got a new one. They had grown into years of close association with E. B. Dennison,

as though he had lived in the house with them, but when they opened this new book they experienced a shock, for it was a new edition of the book, and instead of being by E. B. Dennison it was by Sir Edmund Beckett. This put them on inquiry and they found out that E. B. Dennison was a son of Sir Edmund Beckett Dennison and that when he died in 1874 his son, E. B. Dennison, succeeded to the baronetcy and dropped the Dennison from his name. This knowledge made the new book satisfactory.

* * * The new book was somewhat of an improvement over the old, and Mary and Charlie, who had begun to show gray hairs, read it through two or three times with interest. They wore this book out and nothing would do but Charlie must get another.

* * * Then this third book had another shock for them, for instead of being by E. B. Dennison, or by Sir Edmund Beckett, it was by Lord Grimthorpe. They started their inquiries again and were able to find out that Sir Edmond Beckett was elevated to the peerage in 1886 and took the name of Lord Grimthorpe. They found out that E. Beckett was an authority on clocks and bells and that he had designed the Westminster clock for the Houses of Parliament along in the fifties.

* * * The Westminster clock is the one containing that celebrated bell "Big Ben." The bell is cracked. It was cracked once before and was recast. The new one developed defects, but its sound seems very satisfactory except to its designer Lord Grimthorpe, who died in 1905 with the hope that "the model legislatures of the world, as it is the fashion to call them, may screw up their courage to the undertaking of recasting their own great clock bell."

* * * It thus seems that Charlie's clock has swung its pendulum beat after beat while he and Mary grew old; while their son was born and had a son and died; while E. B. Dennison became Sir Edmund Beckett; while Sir Edmund Beckett become Lord Grimthorpe.

* * * During the numerous readings of the numerous Beckett books by Charlie and Mary they absorbed considerable knowledge, and intelligent knowledge, of the proper shape of gear teeth. And this reminds me that some years ago Mayo had before him a gear problem which stumped him, so, thinking that Gleason could help him out, he rolled up his blueprints and hied himself to Rochester to see Gleason. He called at the office and asked for Mr. Gleason, explaining that he wanted to consult him regarding a rather complicated gear problem. The young lady who happened to respond to his call stated that she could probably attend to the matter for him. Mayo thought not, but he unrolled his blueprints and they started in, and what that young lady was not able to tell Mayo about gearing was not worth asking about. The young lady proved to be Kate Gleason, the secretary of the Gleason Works, an authority on gearing and a member of the American Society of Mechanical Engineers.

* * * And speaking of Big Ben reminds me that Bob and Doc, two young chaps, went over the water, and while in London they frequently heard Big Ben. So one night they determined to take a walk to the Houses of Parliament so as to be on the ground when the clock struck eleven. But then, in their numerous turnings, they found themselves lost until, while in Victoria Street, they saw the sign "The Niles-Bemont-Pond Co." and then Doc says: "Bob, we are no longer lost, we cannot be far from Plainfield."

* * * And this again reminds me that Bob had in his pocket a cheap watch which cost five dollars in Paris. He and Doc one evening while in London took a Thames boat and made a careless and ignorant landing and found themselves at the gate of Greenwich Observatory. They could not pass the gate, but here these two boys unexpectedly found themselves at the center of time. They found themselves at the place that ever since they were children they had seen printed down in the corner of the maps in their geographies. There was a clock at the gate and Doc suggested that they do themselves the rare honor of setting their watches by real Greenwich time. They did so, but it happened that Bob's five-dollar watch was correct to the dot and did not need setting.

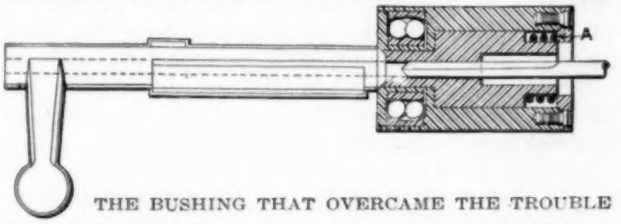
* * * George wanted a little vacation from the drawing room, and he fetched up at Yellowstone Park, where there happened to be a military post where each evening there would be a dress parade, the firing of the evening gun and the lowering of the colors. George got acquainted with one of the officers and explained to him that he was curious to know how they got their time out in that region. The officer explained that there was a jeweler downtown whose regulator was always kept at the correct time and the officers at the post went by that regulator.

* * * But George happened to be downtown and made a call on the jeweler for some purpose, and idly asked the jeweler how he got his time. The jeweler explained that it was simple enough, and that all that he had to do was to listen for the evening gun up At the post. Very respectfully, CHORDAL.

A Bushing For Drilling Breech Bolts

BY JACK FINLAY
New South Wales, Australia

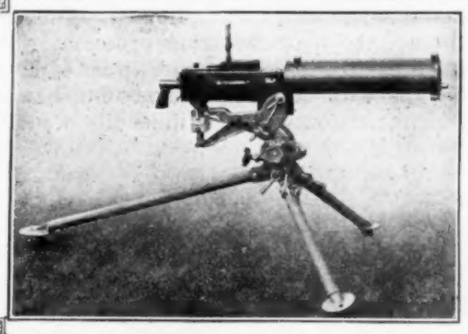
In drilling the firing-pin holes in the breech bolts of service rifles, we have had considerable trouble. In this operation the breech bolt revolves, one end being guided by a countersink in the drill bushing. Sometimes the bolts would run free and at other times



THE BUSHING THAT OVERCAME THE TROUBLE

they would stick or seize in the bushing. The bolts that ran free were glazed or burnished where the chamfered end bore in the countersink of the bushing, leaving a hard skin which quickly dulled the milling cutters used in a later operation.

We overcame this trouble by making a new bushing in which was incorporated an SKF ball bearing, as shown in the illustration. The inner member of the bushing is free to revolve with the breech bolt with which it is kept in contact by the stiff spiral spring *A*. The drilling was done on a Pratt & Whitney deep-hole drilling machine.



HIGH PRODUCTION TOOLING METHODS

AS APPLIED TO THE MACHINE-GUN TRIPOD, MODEL 1918

By

Albert A. Dowd & Donald A. Baker

I. Planning and Organizing

This series of articles takes up the matter of engineering a high-production tooling proposition from start to finish, or in other words, from the planning to the installation of the tools. Furthermore, it shows how such a job can be handled efficiently by an engineering organization specializing on this class of work. Permission has been granted by the Ordnance Department, Washington, D. C., to publish this data.

DURING the war our Government turned over contracts for building military equipment to various manufacturers all over the country. Some of these were well organized and their regular line of manufacturing work compelled them to have excellent engineering organizations of their own which were expanded to suit the abnormal demands of excessively high production along the new lines of manufacture. Others had no engineering and drafting departments and were constrained to organize for the purpose or to have their designing and engineering work done outside of their own factory. Some other firms had a small engineering force and were unable on account of insufficient space, to increase their capacity to an extent great enough to handle the extra work thrust upon them.

The result of this lack of engineering facilities opened up a field for engineering offices, so that various firms who were prepared to do designing and drafting work had an opportunity to get into the game to some extent depending upon their capacity, ability, and the force of men at their command. Ordinarily the manufacturer with his own engineering and drafting organization has found it rather unsatisfactory to have the work done outside. During the war, however, much of the work was handled in this way from force of necessity and in some cases satisfactory results were obtained. Some good work was obtained when the planning of operation was done by the manufacturer to whom the contract had been let. On account of his knowledge of his own equipment of machine tools he was able to lay out operation sheets calling for the various tools needed and turn over the work to an engineering company so that they could design the fixtures for the machine tools as specified in the operation sheets. When this preliminary work was carefully done the results were very satisfactory to the manufacturer, but in some cases the preliminary planning was done hurriedly and the results obtained were not as satisfactory as they should have been.

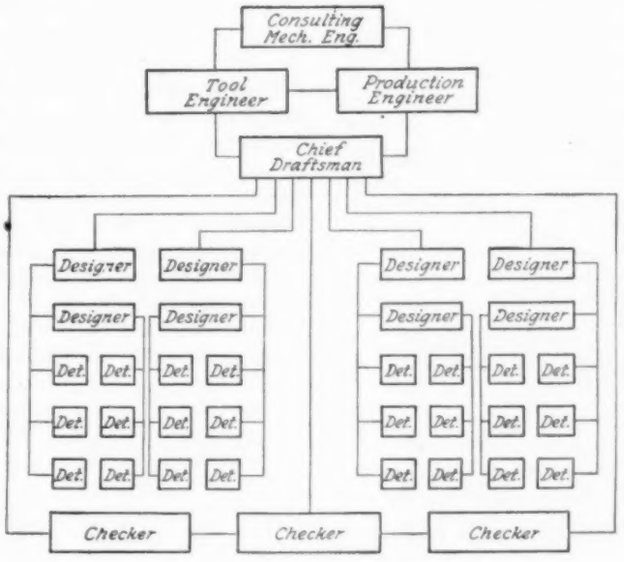


FIG. 1. ORGANIZATION CHART

Some of the best work was done by engineering organizations who were competent to plan the work, establish gaging systems, and design and build the tools. Firms of this kind took over in some cases the entire design of tools and gages for some complete piece of equipment, and carried it through to a successful conclusion. The Service Engineering Co., of 25 Church St., New York, handled a great deal of this work, doing their own planning, designing tools and gages and supervising the building of these tools in various tool shops in and around New York. One of the most interesting propositions handled by this company was the designing of tools, fixtures and gages for the machine-gun tripod, model 1918. It is the purpose of this article to illustrate the methods used and to show how efficiently such an organization can work out and handle a proposition of this kind, finally turning over the tools to the manufacturer ready for use.

It is evident that any engineering organization in handling work for an outside firm is obliged to take the greatest care both in planning and designing, especially when the production runs into a number of thousands of finished pieces. In the case of the machine-gun tripod, 20,000 were to be manufactured and therefore the tools designed were to be of the best. Furthermore, a complete gaging system was required on account of the Government inspection of parts.

As it is evident that maximum efficiency depends

largely upon organization, an organization chart is shown in Fig. 1. A reference to this will make it apparent just how work of this kind can be produced rapidly, and carried through systematically so that the manufacturer commences to get results in a very short time after the order has been placed.

Determining Factors in the Design of Tools

In building a house a man naturally starts at the foundation, and likewise in the design of tools, fundamental points which are determining factors in the design must first be taken into consideration. Starting at the bottom, therefore, any engineering firm which is to handle an outside proposition must know:

(A) Production required.

It is evident that if a small production is needed on any given piece of work the tools should be made as simple as possible in order to make the unit distributed

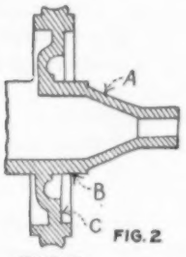


FIG. 2

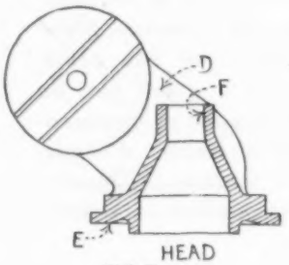


FIG. 3

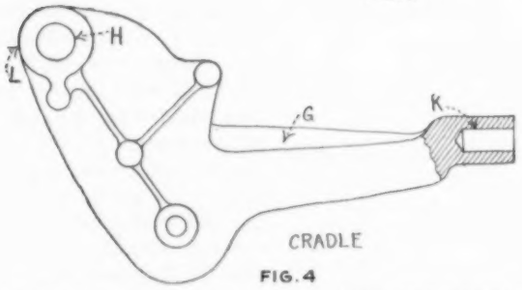


FIG. 4

FIGS. 2 TO 4. SELECTION OF WORKING POINTS
Fig. 2—Pintle. Fig. 3—Head. Fig. 4—Cradle.

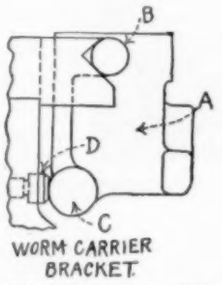
cost as low as possible. On the other hand, if a large production is required, the tools can be much more elaborate and the methods of locating and clamping can be so arranged as to permit the greatest rapidity in handling.

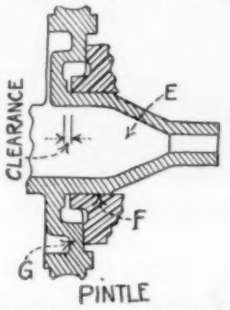
(B) Accuracy desired.

It is obvious that a farm implement, like a mowing machine, does not require so great accuracy in manufacture as a sewing machine, typewriter or something of this kind. In either case, however, it is necessary before going ahead with the design of tools to determine the permissible tolerances on the work so that due precaution can be taken in the design of tools, and to control the size of the work so that it will be manufactured within the required limits. Assuming that certain holes or shafts are to be held within a tolerance of 0.0005 in., in all probability it would be necessary to grind both the hole and the shaft, while if the tolerance were 0.003 in. to 0.005 in. the hole could be reamed and the shaft turned. So it will be seen that the accuracy desired affects both the tool equipment and the machine tools used.

(C) Machine tools available or to be bought.

The machine tools available in different factories have also an important bearing on the work to be produced. Assuming that the machine-tool equipment is modern and well kept up, the manufacturing processes would be much simplified. On the contrary, with antediluvian machine tools and with other equipment of a like nature, it is evident that considerable ingenuity would be





FIGS. 5 AND 6. LOCATION OF WORK IN FIXTURE
Fig. 5—Worm carrier bracket. Fig. 6—Pintle.

necessary in the design of tools to conteract the inaccuracies of the machines.

(D) Human factors used in production.

The workmen who handle the machines affect the design of tools very largely. In a factory where unskilled labor is used, the tools must be designed in such a way that they are strictly foolproof and all kinds of provision must be made to lessen the chance of error resulting from this class of labor.

Fundamental Points Affecting the Design

The four points which have been taken into consideration in the paragraphs just preceding, must be borne in mind throughout the design of tools. In addition to these points there are many others which must be considered for each individual case. Perhaps the best method of indicating what these points are, is to cite them briefly here and then show their application to various conditions when describing the tools illustrated in the body of the article. In the design of the tools for the machine-gun tripod, the production is sufficiently high to warrant a considerable expenditure for this

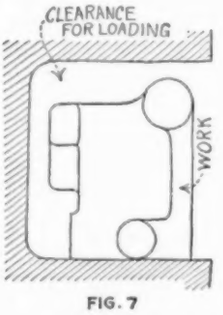


FIG. 7

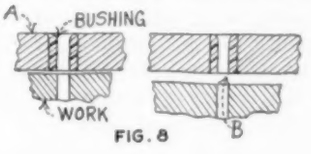


FIG. 8

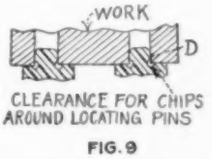


FIG. 9

FIGS. 7 TO 9. CHIP AND LOADING CLEARANCES
Fig. 7—Loading clearance. Fig. 8—Clearances below drill bushings. Fig. 9—Clearances around locating pins.

purpose. We shall, therefore, consider the tools from the viewpoint of those wanted for high production and shall not take up points in design which would be necessitated by low production work. Perhaps the best way to make the matter clear is to make a definite statement that the production required was high; the accuracy required extremely close; the machine-tool equipment of the best and extra machine tools bought when the proper machine was not available; and the human

factor of unskilled labor, both male and female. In many cases girls operated milling machines, light gear cutters and some other machines not requiring hard manual labor.

The selection of working points is of extreme importance and it is advisable to lay out the operations on the work in such a way that after one or more machining operations, it can be located for the remainder of the operations by the same locating points or surfaces. If this is done, there will be little trouble experienced from inaccurate work, but on the other hand, if one working point is used to obtain another surface for subsequent operations, and so on using different working points as the work proceeds, nothing but final disaster can result. If the tools can be so arranged that a surface in one plane and a hole at right angles to it can be machined early in the operations, these can be used to work from throughout the handling of the work with excellent results. This matter will be more fully treated under the description of methods and laying out operations.

Several examples of the selection of working points

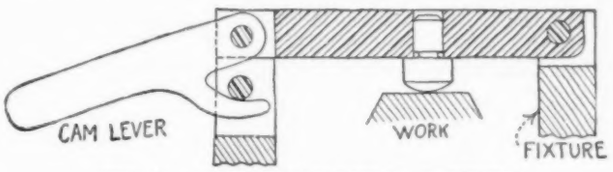


FIG. 10. SINGLE CAM-LEVER FIXTURE

are shown in Figs. 2 to 4. In Fig. 2 which shows the pintle *A* of the machine-gun tripod, the important working surfaces are noted at *B* and *C*. These two surfaces are machined within the limits specified in the first operation and they are used to work from in all subsequent operations. The method of holding for the first operation will be taken up when starting the turret-lathe operations. In Fig. 3 which shows the head *D* of the machine-gun tripod, the surfaces *E* and *F* are used to work from after they have been machined in the first operation on a turret lathe. The method of holding for the first operation will be illustrated when describing the turret-lathe tools. In Fig. 4 showing the cradle *G* of the machine-gun tripod, the working points are the holes *H* and *K* (which, it will be noted, are in two different planes) and in addition thereto, the two milled surfaces between the lugs *L* which are not shown in the illustration. These are used for working points throughout the machining operations.

If the work has had no previous machining operation, it is evident that the locating points must be arranged so as to work from the casting or forging in the rough state. It is well-known by all tool designers that rough castings or forgings must never be located on more than three fixed points. If any others are necessary, they must be made adjustable and provided with an efficient method of locking after adjustment. Locating points must be so arranged that they will strike on clean parts of the casting or forging, so that variations will not be caused by improper location against fins, flashes, gates, or other inequalities on the work. It is very important that all locating points should be readily accessible, so that they can be cleaned without difficulty, in order to make sure that locations will not be affected by dirt or chips accumulating on the points.

Referring to the worm carrier bracket *A* in Fig. 5, the location of the work for the first operation is in V-blocks on the rough bosses *B* and against the lug *C*. It will be noted that both of these lugs would be likely to be free from inequalities which would tend to cause improper location. It is apparent that both the V-block and locating pin *D* should be hardened and so arranged that they can be easily replaced in the event of wear.

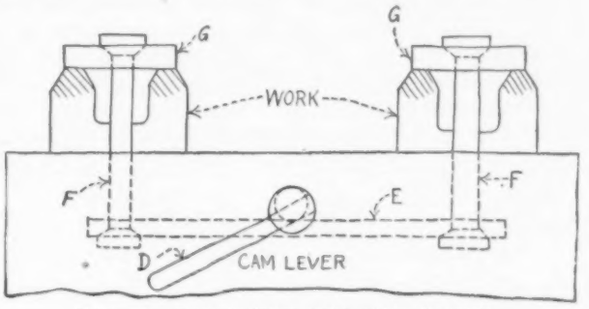
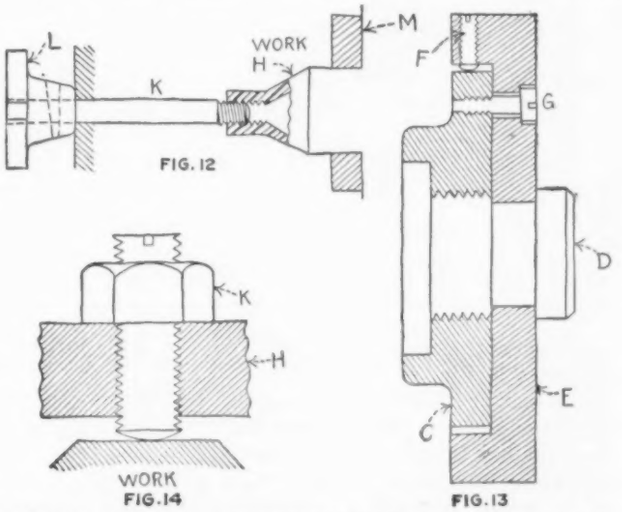


FIG. 11. CAM LEVER FOR TWO PIECES

If the work has been machined in a previous operation, still greater care is necessary to insure correct location of the work on the locating points. In cases of this kind it is unnecessary to have three points of location although this is sometimes desirable, in order to have fewer surfaces to clean. Considerable care must be used, however, in clamping in order not to distort the work or throw it out of position.

An example of this kind is shown in the location of the pintle *E* in Fig. 6, which has been finished in a previous operation as described under the preceding heading. Also as the surface *G* bears a fixed relation to some of the important working parts of the tripod, no better place can be selected from which to work than that indicated. It is evident from the two examples shown that the location of the work on the fixture is



FIGS. 12, 13 AND 14. PROVISIONS FOR UPKEEP OF TOOLS.
Fig. 12—Pull-back device. Fig. 13—Adjustable faceplate.
Fig. 14—Adjustable contact stud

of sufficient importance to merit careful consideration in planning.

The matter of clearances in the fixtures must be considered in order to make sure that there will be plenty of chip room, and that the sides of the fixture do not approach too closely to the work, so that the loading can be readily accomplished. In this connection it should be borne in mind that castings or forgings vary

somewhat in size, and therefore the clearances around the work should be ample to take care of these variations, as indicated in Fig. 7. Plenty of hand clearance must also be provided. The chips which come from a drill or any other tool sometimes cause trouble unless proper provision is made. In the case of drill bushings these should be right down on the work as shown in Fig. 8 at *A*, or should have sufficient clearance between the end of the bushing and the work, as shown at *B*, so that chips will not pack or crowd between work and bushing and cause trouble. When locating pins or studs enter holes in the work, it is necessary to make sure that dirt or chips do not collect at these points. Pins a screw. This sometimes makes it necessary to provide equalizing devices so that a clamp will rock on a rough surface and will, at the same time, carry the work into its proper position against locating points or surfaces.

The matter of rigidity under the pressure of the cut is especially important when milling fixtures are to be designed. Speaking generally, these should be heavy and provided with plenty of backing immediately behind the portion of the work on which the cut is being taken. Turret-lathe fixtures also need to be made so that the work will be very well supported to prevent "chatter." In a drill jig where a thin portion is to be drilled, this portion must be well supported so that the

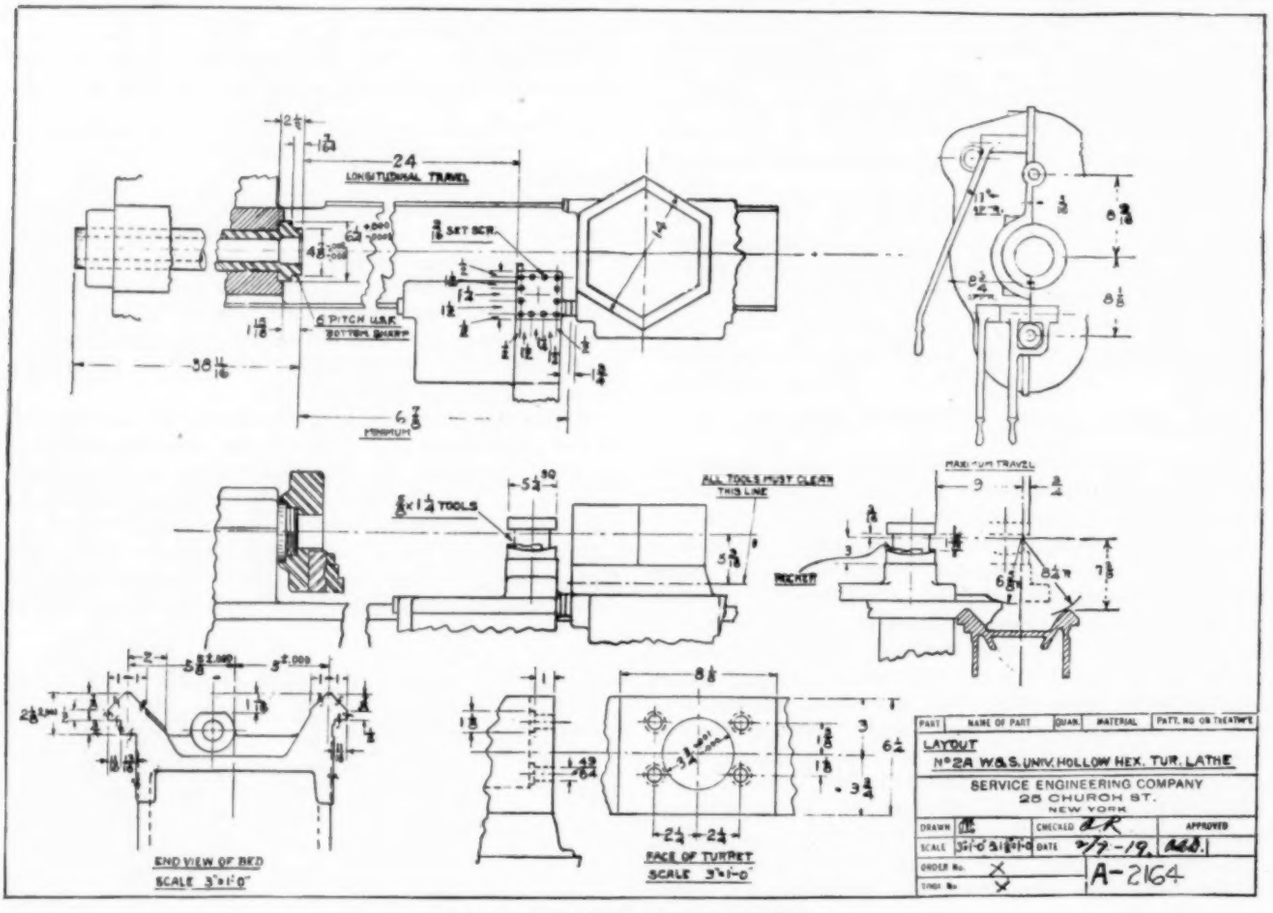


FIG. 15. REFERENCE DATA SHEET

are frequently recessed or grooved for this purpose, as shown in Fig. 9.

The matter of holding the work in position in the fixture is one of the most serious problems which the tool designer has to solve. It is necessary to take into consideration such things as distortion of the work due to an improper method of clamping, improper location caused by the action of the clamps tending to throw the work out of its true position, and one clamp acting against another so that there is a possibility of an error in setting up the work in case one clamp should be tightened before another one.

The matter of making a fixture foolproof so that the work cannot be placed in position wrongly should be given considerable attention. In high-production fixtures it is desirable, if possible, to arrange the clamping system so that the work can be placed in position and held firmly with one movement of a lever or one turn of work will not spring away from the drill during the machining.

Figs. 10, 11 and 12 show several examples of clamping methods in common use. Fig. 10 shows an ordinary type of cam lever and leaf clamp, the action of which is familiar to all tool designers. Fig. 11 shows a method of clamping two pieces at the same time with an equal amount of pressure by using a cam lever *D* operating on a connecting link *E*. The latter in turn pulls down the bolts *F* which operate the clamps *G*. The example shown in Fig. 12 is an ordinary pull-back arrangement frequently used in turret-lathe work to hold a threaded piece back against a faceplate. The work *H* has been previously threaded so that it receives the end of the screw *K*. By the operation of the knob *L*, the work is drawn back against the locating surfaces *M*, as indicated.

The replacement of locating pads, pins, bushings or

S. E. No. 523-A Tool No. E-34498
Customer P. O. No. A-19843
Name of Tool Special Chuck for holding spindle part # 300-58 on # 2A-W. and S. Turret Lathe.

Date
Designing
Detailing
Checking
Remarks:

FIG. 16. INSTRUCTION CARD

any other parts which are subject to wear, must be provided for. In high-production tools all of these items should be made of hardened steel and so located that they can easily be trued up or replaced by other parts when worn. Provision should be made for driving out locating pins if necessary for replacement. Cutting tools should be so designed that they can be adjusted and reground a number of times.

Referring to Fig. 13 an adapter *C* is shown which screws on the end of a turret-lathe spindle. The work is located on the stud *D*, which is fixed in the faceplate *E*. In order to provide for truing up the faceplate on the machine, it is so mounted that adjustment for concentricity may be made through the screws at *F* and *G*. Another example of provision for the upkeep is shown in the adjustable locating stud in Fig. 14. This stud is screwed into the body of the fixtures *H* and has a locknut at *K*, which holds it in place after it has been adjusted.

Attention must be paid to the operator's safety, and precautions must be taken to prevent accident due to careless handling of the fixtures. Projecting setscrews or lugs on revolving parts should be avoided, and anything which will tend to catch in the operator's clothing must be guarded against. At the present time there are many girls working in machine shops, running milling machines and other tools, and for this class of operators it is particularly desirable to make all possible provisions for safety.

The selection of the machine tools to be used on a given piece of work is of considerable importance. It is usually necessary to have the coöperation of the manufacturer for whom the work is being done, in order

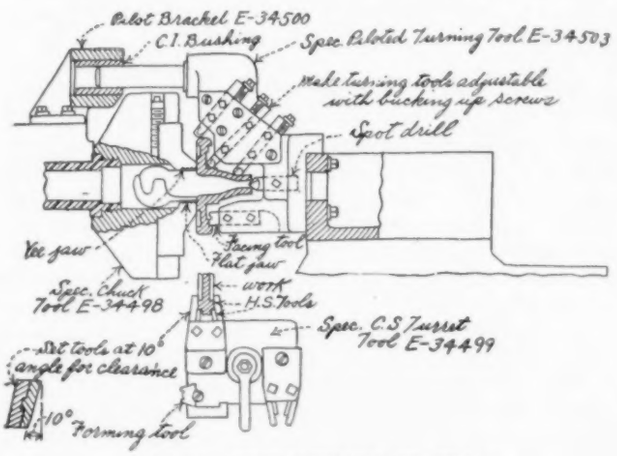


FIG. 17. PRELIMINARY SKETCH

that the machines selected will be such as can be profitably spared from production of any other work which may be in process at the time. Any engineering firm which handles work of this character, must be provided with diagrams and data of all kinds of machines in use. The accumulation of this data and its upkeep is an important factor in the design of tools, because constant reference is made to it during the progress of

SERVICE ENGINEERING CO. TOOL No. 6A-1
CHECKERS SLIP DWG. No. P-41801

✓	Design: change as noted below
✓	Easy and Straight to Read
✓	Each Part Correctly Illustrated
✓	Title ✓ Part No. ✓ Tool No. ✓ Dwg. No. ✓
✓	Stamping
✓	Checking Dimensions see notes
✓	Clearances
✓	Limits
✓	Specifications of Material
✓	Treatment of Material
✓	Pattern Nos.
✓	Finishes
✓	Checking Corrections
✓	Tie up with other Tools none
✓	Review

REMARKS:
(1) Change $4\frac{27}{32}$ to $4\frac{29}{32}$
(2) Make $\frac{7}{16}$ threaded hole ½" std
(3) Increase thickness of wall to $\frac{3}{4}$
(4) Specify thd diam 4 × 5 pc.
(5) Make plug hole so that plug can be easily removed if necessary

DATE 8/24-18 O. K. A.R.

FIG. 18. CHECKER'S SLIP

the design in order to make sure that there are no interferences of any kind with the various parts of the machine when in operation.

An example of one of these sheets is shown in Fig. 15, this being a Warner & Swasey No. 2A turret-lathe. It will be seen that all important data in regard to the maximum and minimum movements of the machine and other points which involve the matter of clearances are specified on the sheets. There is also another sheet (not shown) which gives dimensions of all standard tools, so that adaptations of these can be made when necessary. The sheets mentioned are standard size drawings, which are in loose-leaf form and carefully filed so that they can be referred to at any time.

The System Used in Planning Work

Very few manufacturing organizations would attempt to put through any work in the factory without knowing pretty well how they were going to do it. It is fully as important in an engineering organization

to carry out the various steps logically in order to gain maximum efficiency. Let us assume that the work which is to be done is in the nature of a tooling proposition. Let us take up the steps through which such a proposition is carried to a successful conclusion, using as a basis illustrations of the machine-gun tripod, model 1918. A number of tools and gages used in the production of this mechanism will be shown in this series, and comments made when needful.

The first logical step in the development of a tooling proposition is an open conference of the engineers on the various parts of the mechanism which are to be tooled. At this conference the parts are taken up separately and considered with a view to the best method of handling the various machining propositions. Working points are suggested, and a general attempt is made to see what parts are of the greatest importance and how the operations can be carried through to the best advantage in order to secure the desired production within the required limits of accuracy. It is highly desirable that the rough castings or forgings of the parts should be on hand at this conference and it is a great advantage to the tool engineer to be able to look the parts over when planning the operations. The object of the conference is to concentrate a number of trained mechanical minds on a single proposition and thus take advantage of their specialized experience. Discussions arise as to locating points, working points, and the suitability of various machines for a given piece of work, and it is possible through a conference of this kind to analyze the proposition thoroughly and obtain highly satisfactory results.

At the conference, it is customary to rough out a method of handling for a given part, and the tool and production engineers make notes for their future guidance. These notes of the methods of handling are subject to revision when the work is gone over in detail by the engineers in laying out the operation sheets. As a matter of fact, however, unless the proposition is a very complicated one, the sequence of operations is generally not changed greatly. The memoranda taken at the conference give very good data for a starting point, so that sketches can be rapidly made to put into the drafting room in a short time after the work has been taken over.

In laying out the operation sheets the tool and production engineers work hand in hand, using the data obtained from the conference and afterward gone over carefully to determine whether there are any weak points in the methods or not. Referring to Table I, a completed operation sheet is shown on the pintle for the machine-gun tripod, model 1918. It will be noted that all tools and gages needed on the work are carefully itemized and given a tool number. The work which is to be done and the working points are carefully specified. The various dimensions to which parts are to be finished are also specified. There are no generalities used; everything is definite and to the point. It is by no means necessary for the chief draftsman to have a copy of the operation sheets in detail before he proceeds to hand out the work to his tool designers, but he is frequently called in to a conference with the tool and production engineers so that he understands thoroughly what the sequence operations is. In this way he keeps in touch with the entire proposition as it progresses.

TABLE I—OPERATION SHEET

Oper. No.	Description of Operation and Method of Holding Work	Type of Machine	Tools, Gages and Fixtures	Tool No.	S. E. Co. Order No.
1	Inspect casting				
2	Grind off gates				
3	Sand blast				
4	Hold by outside of segment end in special 2-jaw chuck	No. 2A W. & S. Turret Lathe	Special chuck	6A-1	528-A
			Multiple turn. head	6A-102	528-B
	A: Rough turn 0. diameter		Bracket on Headstock	6A-102	528-F
	Rough turn 2.040 diameter		Gage for setting tool	6A-102	528-D
	Rough turn 0.915 diameter		Spotting drill	6A-102	528-C
	Spot drill end				
	Rough bore and face 4.210		Special C. S. tool block	6A-103	528-E
	Rough face both sides of flange				
	Rough straddle shoulders 0.580				
	B: Finish turn 2.009 diameter		Multiple turn head	6A-102	528-G
	Finish turn 0.885 diameter		Setting gage for tool	6A-102	528-H
	Finish bore and face 4.240		Face mill for end	6A-002	528-I
	Rough face end 0.885 diameter		Spec. C. S. tool block and tools	6A-103	528-E
	Finish face both sides flange				
	Finish straddle 0.560 shoulders				
	C: Size 1.999 diameter		Mult. turn head	6A-102	528-J
	Size 0.8745 diameter		Setting gage for tool	6A-102	528-K
	Size 4.250 diameter		Face mill for end	6A-102	528-I
	Finish face end of 0.875 diameter		Form tool	6A-003	528-E
	Form worm gear blank				
	D: Drill hole for ¼ in. tap		Drill holder	6A-104	528-L
			Tap drill	6A-104	528-M
	E: Tap ¼-13th hole		Tap holder	Std.	
			¼-13 thread tap	Std.	
			Gages		
			0.560 snap gage		528-X
			Templet for gear form		528-Y
			5.1726 throat diameter		528-Z
			Recess depth		528-ZA
			4.250 diameter		528-ZB
			1.999 diameter snap		528-ZC
			Bottom of recess to end		528-ZD
			0.8745 snap		528-ZE
5	Straddle mill segment end	No. 4 Cincinnati Milling Mch.	Milling fixture	6A-2	528-N
			Straddle mills	6A-2	528-O
			Gages		
			Gage for relation of side to centerline		528-ZF
6	Stationary drill jig	Drill Press	Drill jig	6A-3	528-P
	Drill and ream ½ hole using ⅝ drill and ½ reamer		Magic chuck	Std.	
			⅝ drill	Std.	
			½ reamer	Std.	
			Gages		
			½ plug		528-ZG
7	Mill ratchet teeth on segment end	Plain Milling Mach.	Milling fixture (Index)	6A-7	528-Q
			Formed milling cutter	6A-7	528-R
			Arbor		528-S
			Gages		
			1⅛ radius over top of teeth		528-ZH
8	Drill 0.246 hole	Sensitive Drill	Drill jig	6A-4	528-T
			0.246 (*d*) drills	Std.	
9	Drill 0.128 diameter hole	Sens. drill	Drill jig		528-U
			0.128 (No. 30) drills	Std.	
10	Stamp figures and graduations	Punch press	Punches, dies and holders	6A-5	528-W
11	Hob the worm gear		Hobbing fixture	6A-6	528-W
12	Test worm gear		Testing fixture		528-X
13	Inspect				

While the production engineer is laying out the operation sheets the tool engineer makes sketches on section paper in approximate proportion for the various tools and gages to used in the work, Fig. 17, and at the same time he writes a card, Fig. 16, which gives the draftsman the name of the tool and where it is used. It will be noted that the sketches of the tools are rather rough as they are made somewhat rapidly, but the locating points and general methods of clamping are carefully worked out so that when the tool designer gets the information, the entire matter is very clear to him. The instruction card to the draftsman is so arranged that a record of the time spent on the drawing can be kept on it and filed away for reference. It will be seen that a system of this kind leaves nothing to chance and gives the chief draftsman an opportunity

to select the best man for the various jobs and to plan in advance just how he can put the work through to the best advantage.

The system by which the jigs, fixtures, and gages are designed and detailed is as follows: The chief draftsman hands over the sketch and instruction card to one of his tool designers who has under him three or more detailers. The tool designer works out his design on brown paper, not being very particular as to accurate dimensions, but getting the idea worked up. When the idea has reached a stage so that it can be criticized the chief draftsman makes any suggestons that he may find advisable, and after these suggestions have been embodied in the design, the rough layout is handed over to one of the detailers who works up the design carefully on tracing paper. When this is completed the detailer draws up the various details so that the work can be placed in the shop.

If the work is being done subject to approval by the chief engineer of the concern for whom the work is being done, it is the custom to submit a rough design to him for approval before handing it over to the detailers. This process is of course unnecessary when the responsibility is entirely assumed by an engineering concern.

After the tools have been designed and detailed, they are ready for the checking and are set aside for this purpose, subject to the checker's requirements. In checking over the drawings it is advisable to use a checker's slip as shown in Fig. 18. It will be noted that this slip specifies certain things which are to be checked on all drawings and leaves a space for other corrections and remarks. These sheets are made so that they can be filed in a loose-leaf book and safely kept for future reference in the event of any controversy in regard to changes in design or corrections. Sometimes there are several of these slips on a single drawing, and it will be noted that the corrections are given a number so that quick reference may be made to each one by the draftsman who makes the corrections. A system of this kind in checking eliminates the possibility of an omission on the part of the checker and provides a permanent record of the thoroughness with which the drawing has been checked. After the corrections have been made, the drawings are blueprinted and are ready to send to the pattern shop and toolroom.

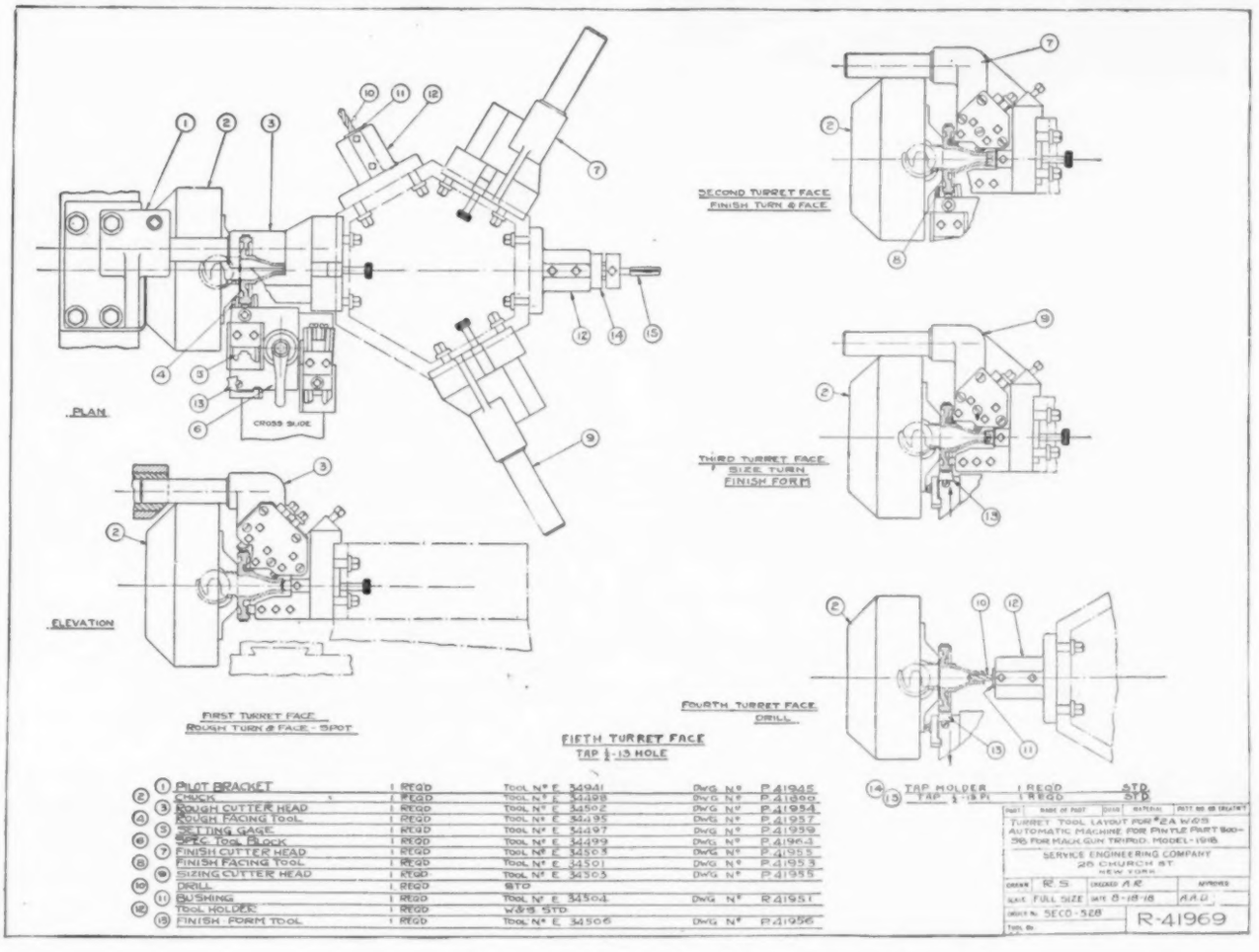

PLAN
ELEVATION
CROSS SLIDE
FIRST TURRET FACE
ROUGH TURN & FACE - SPOT
SECOND TURRET FACE
FINISH TURN & FACE
THIRD TURRET FACE
1" SIZE TURN
FINISH FORM
FOURTH TURRET FACE
DRILL
FIFTH TURRET FACE
TAP ½-13 HOLE
1 PILOT BRACKET 1 REQD Tool N° E 34941 Dwg. N° P41945
2 CHUCK 1 REQD Tool N° E 34198 Dwg. N° P41960
3 ROUGH CUTTER HEAD 1 REQD Tool N° E 34502 Dwg. N° P41954
4 ROUGH FACING TOOL 1 REQD Tool N° E 34195 Dwg. N° P41957
5 SETTING GAGE 1 REQD Tool N° E 34497 Dwg. N° P41959
6 SPEC. TOOL BLOCK 1 REQD Tool N° E 34499 Dwg. N° P41963
7 FINISH CUTTER HEAD 1 REQD Tool N° E 34503 Dwg. N° P41955
8 FINISH FACING TOOL 1 REQD Tool N° E 34501 Dwg. N° P41953
9 SIZING CUTTER HEAD 1 REQD Tool N° E 34505 Dwg. N° P41955
10 DRILL 1 REQD STD
11 BUSHING 1 REQD Tool N° E 34504 Dwg. N° R41951
12 TOOL HOLDER 1 REQD W&S STD
13 FINISH FORM TOOL 1 REQD Tool N° E 34506 Dwg. N° P41956
14 TAP HOLDER 1 REQD STD
13 TAP ½-13 PI 1 REQD STD
TURRET TOOL LAYOUT FOR 2A W&S AUTOMATIC MACHINE FOR PINTLE PART 900-36 FOR MACHINE GUN TRIPOD. MODEL-1918.
SERVICE ENGINEERING COMPANY
28 CHURCH ST
NEW YORK
DRAWN R.S. CHECKED A.R.
SCALE FULL SIZE DATE 8-18-18 A.A.G.
ORDER № SECO-528
R-41969

FIG. 19. TOOL LAYOUT FOR TURRET-LATHE WORK

It is very desirable in any work of an important nature to lay out the various operations to scale in order to show the tooling set-up, so that the workman in the factory can understand exactly how the various tools are to be used. An example of a turret-lathe layout for the pintle of the machine-gun tripod is shown in Fig. 19, and it will be noted that all of the tools are shown in position and that the various operations on the work are illustrated diagrammatically. The actual job is shown in Fig. 20. In addition to this data a complete record of the tools themselves with the tool numbers is given at the bottom of the sheet. When a system like this is used, it is a simple matter for the workmen to grasp the method of handling on a given piece of work and

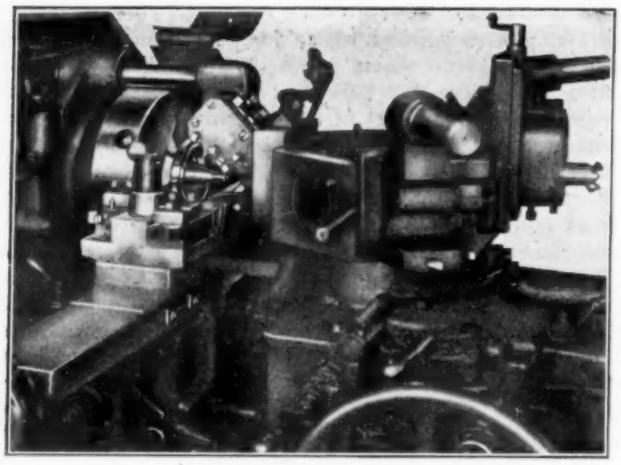


FIG. 20. TOOL SET-UP FOR TURRET-LATHE

set up his tooling equipment without making use of the "cut and try" methods.

A reproduction of the first sheet of workmen's instruction cards is shown in Fig. 21 for the tool layout which has been mentioned. A reference to this figure will disclose at the upper left-hand corner a partial drawing of the work, giving only the dimensions to which the piece is machined in the operation specified. A general description of the operation is given at the right and the remainder of the card specifies in detail just how the operation is to be performed, the tools required, and the tool numbers. The cutting speed in feet per minute together with the revolutions per minute and the feed are also specified.

It is possible for a workman to take this card to the tool crib when starting in on a given piece of work, determine from it just what tools he needs and then place them in position on the machine by referring to the tool layout. He can then go ahead with his production, being governed as regards his cutting speed by the instructions on his card. If, after this, production does not reach the amount desired, or if he finds that he cannot run at the specified speeds, he must consult with his foreman who will take it up with the production engineer and see where the trouble lies. It is entirely possible, however, to specify this work so carefully that changes are seldom found necessary in either the set-up or in the time specified for the work. There are, of course, cases when the castings are particularly hard and the cutting speeds called for cannot be used, but in the majority of cases this matter can be remedied by more careful attention on the part of the foundry man.

In building the jigs, fixtures, and other tools used, the most careful supervision must be exercised in order that no mistakes can occur which will tend to make the work inaccurate. Proper toolmaking methods together with good supervision, and machine tools of up-to-date character operated by workmen of ability, insure that the tools will be in accord with the drawings and leave little chance for argument on the part of the inspector after they are finished.

Factory Coöperation Necessary

Coöperation with the factory for whom the tools are made by assisting to start production after the tools have been designed and built, and the following up of the design and building of tools with their proper installation, are valuable factors in the services rendered.

The next article of the series takes up the design of tools in detail.

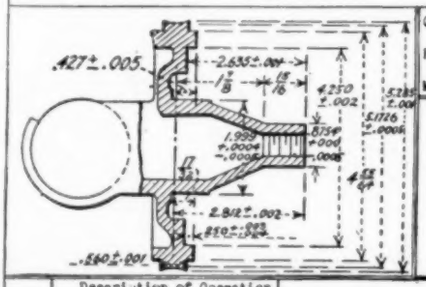
Rate of Depreciation of Office Equipment

By Robert L. Avery

In computing the depreciation on "furniture and fixtures"; that is, on office equipment such as furniture, filing cases, typewriters and the like, it is customary to assume that it depreciates at the rate of 10 to 20 per cent. per year. In the Milwaukee three-cent case, one of the experts retained assumed a depreciation rate of 12½ per cent. on furniture and fixtures, while three others assumed a rate of 20 per cent. Probably a 15 per cent. rate would be a fair average value for usual conditions.

WORKMAN'S INSTRUCTION CARD 1/5

NAME OF FIRM Nelson Blower & Furnace Co.



Oper No. 4 Part No. T-18-8A

Name Pintle

Mach. #2A W & S Turret Lathe No.

GENERAL DESCRIPTION of OPERATION

Finish turn, form and face worm gear blank; finish bore and face recess; finish turn and face .8745 diam. finish turn 1.999 diam. drill and tap 1/2-13 hole.

Item	Description of Operation and Setting up Instructions	Tools Required	TOOL NUMBER	Cutting Speed Ft/Min.	R.P.M.	Feed	Time Required Min.	Prod. Per Hour
	Place work in chuck. Hold by outside of segment end (with open side toward movable jaw) in special 2 jaw chuck.	2 jaw chuck	6A-1				1/2	
	Set various tools to dimensions specified. Lock carriage in position. Set working stops and feed knockoffs.	(3) Setting Gages	6A-102					
1	Bring up turret and throw in feed specified						1/8	
	Turn O.D. to 5-5/16	Mult. Turn. Head	6A-102	110	78	34	1/2	
	Turn 2.040 diam.	Bracket on Head-stock	6A-102					
	" .915 diam.							
	Spot drill end	Spotting Drill	6A-102	Tools working at same time				
	Bore and face recess to 4.210 diam. .240 deep							
2	After starting turret feed bring up C.S. and throw in feed specified	Spec. C.S. tool block and tools	6A-103	110	78	34	1/8 1/2	
	Face both sides flange							
	Straddle face shoulders .580						1 3/4	

FIG. 21. WORKMEN'S INSTRUCTION CARD

Computation of Earnings

By CHESLA C. SHERLOCK

Perhaps the knottiest problem in arriving at a fair compensation for injury to a workman is in determining what should constitute the average annual earnings for the year preceding the accident. The man may have worked only a part of a year with his present employer or he may have lost considerable time from unavoidable causes. Should he receive the same amount as one who has faithfully put in full time or should he be classed with the man who is a part-time worker from choice? Then too what is to be done in the case of a workman in a seasonal occupation such as canning?

PROBABLY there is no subject under the workmen's compensation acts which is so fruitful of dispute between employers and workmen as the computation of earnings. The compensation acts attempt to reimburse an injured workman for his loss of earning power or efficiency by the payment of weekly compensation based on an average percentage of his annual earnings for the year next preceding the date of injury. The percentage of compensation payable varies in the respective jurisdictions where the system is in force, running all the way from 50 to 75 per cent. of the workman's earnings.

The difficulty is in reaching the amount of the workman's "average annual earnings" for the year next preceding the date of injury. If a workman has been employed only a short time or has been employed for a full year, but has been absent from work for a long period during that year, he objects most strenuously to the annual basis of computation and contends for a weekly basis.

As an illustration of the difficulty let us suppose that John Smith has been employed for more than one year in a factory at a weekly wage of $18 but has not been regular in his work, laying off from time to time for various causes. On receiving a compensable injury he contends that since the law in his state allows him 50 per cent. of his average weekly wages he is entitled to $9 compensation. The employer does not agree as that has not been the average weekly wage of Smith for the "year next preceding the date of the injury." The employer produces his books and shows Smith that he has worked only 250 days of the year preceding the date of the injury.

Smith was a six-day worker and earned $3 a day, which multiplied by 250, the number of working days he had been on duty, and divided by 52, the number of weeks in the year, shows his average weekly earnings for the year preceding the date of injury to have been slightly less than $14.50. The employer offers compensation of $7.25, which Smith refuses.

This is a typical problem arising in the computation of compensation and is doubtless experienced by employers in nearly every line of industrial activity. There is merit on both sides, but the matter cannot be definitely settled until the courts have acted on the matter and laid down rules of interpretation which are fairly well understood.

Employers as a rule consider the expression of the statutes upon the subject of computation, "the average annual earnings," to mean the actual earnings of the workman for the year prior to his injury. They advance the theory that there is no better way of compensating a man for what he has lost than by taking his actual yearly earnings and dividing his loss with him on the percentage named by the statute.

This probably sounds fair to all. Why should a worker, who while physically possessed of the means of earning a living has earned at the rate of only $14.50 a week for the year preceding the date of injury, be compensated as if he had been fruitful and diligent and had earned $18 a week? If he was a faithful, hard-working fellow this theory would compensate him the more for his industry, while if he was lazy or indifferent and could lay off from time to time and still collect as much compensation as the diligent workman it would tend to demoralize industry and place an unequal burden on the employer and on the faithful workman.

This is doubtless a true conception of the basic principles of the compensation system, and it would obtain more universally if all workmen could be considered justly as belonging to the same class. But the theory fails in the estimation of the courts because it does not present a solution applicable to all workmen alike.

An Illustration

Let me illustrate. Suppose that John Smith, instead of working a full year for his employer prior to the injury, had worked for the said employer only two weeks before he received the accident which destroyed his earning power or impaired his efficiency. On what basis under this system would the employer compute the compensation due?

In this case Smith has no annual earnings that can be ascertained. The employer does not know whether he is a steady fellow or not. He might be faithful and at the end of the year show a steady income of $18 a week or he might find one excuse or another to lay off and decrease his yearly earnings because he preferred to rest rather than work steadily. It is obvious that the theory of computation advanced above would fail to take care of all workmen who had worked for their employers for less than a full year preceding the date of injury.

And another situation arises which demonstrates the injustice of the theory mentioned. A workman might be absent from work so as to materially reduce his average yearly income through reasons which in no way reflect on his ability and faithfulness as a worker. He might have had sickness in the family; he might have been ill himself or have been kept from his work by other legitimate causes. But under this theory he would be classed with the lazy, shiftless, floater type of workman. The latter class might actually have no greater earning power than was reflected in their wages for the

year preceding the injury, while the first type of workman might have all the actual earning power of a workman who had remained at his bench every working day of the year had unforeseen events not intervened.

In instances where the workman has been employed for less than a full year at the time of his injury it is naturally necessary to ascertain his "average annual earnings" by taking the daily wage and multiplying it by the average number of working days in that particular employment. Very often the statutes specify this method, fixing the average number of working days for all average employments and making provision for a special number being used in case the occupation affords only seasonal or limited employment throughout the year.

The average number of working days in one year in the average employment is generally placed at 300 days. If the statute allows compensation at the rate of one-half of the average weekly wages the compensation due such a workman is ascertained by multiplying the daily wage by 300 and dividing the result by 104, or by 52 and again by 2.

While this method may be criticised by some, it is the only method which can be adopted to cover all cases. It is just to the man who has worked for a full year because it is seldom that a workman, however diligent and steady he may be, works over 300 days in one year. If the workman is only a five-day worker it may appear to work a hardship on him, but it is generally the case that five-day workers receive a slightly higher daily wage than six-day workers in the same employment, so that the higher daily wage will serve to take care of them. It does work a hardship on the seven-day workers, but provision is generally made to take them outside the operation of the 300-day rule.

The Iowa Supreme Court Decision

It has fallen to the lot of the Iowa Supreme Court to decide a case which is generally considered the leading case on the subject of computation. The state of facts center around a miner, and while mining is slightly foreign to the machinery trade the case is valuable to all employers because of the decision reached.

Said the court: "During a year beginning in June, 1914, and ending in June, 1915, the appellant worked 224 days and his gross earnings were $970.66. The tribunals below awarded him a weekly compensation of $8.48. This was arrived at by deducting from the said gross earnings an expenditure for powder and another for blacksmithing, and dividing the amount of earnings remaining after such deductions by 52. The appellant contends, first, that these deductions should not have been made; second, that the average daily earnings on the basis of having earned $970.66 in 224 days should have been multiplied by 300, the sum thus found divided by 52. The method of computation approved below resulted in said weekly award of $8.48. The method contended for by appellant would yield $12.50."

After examining the state statute at some length the court continued: " . . . It appears clearly, without aid from reasoning or case law, that the applicant was entitled by statute to receive 50 per cent. of the average weekly wages received at the time of the injury; that in computing he should be dealt with as one having annual earnings, and that his award should be fixed by taking 300 times his daily earnings in the year preceding and dividing the sum so arrived at by 104."

This decision was much criticised at the time it was rendered because the court decided for something which was not contended for by either party, but the decision was well taken because it declared for a position which has been taken by most of the courts of other states who have examined the subject of computation of compensation.

Decisions in Other States

In a California case the commission took the decedent's daily wage of $2.75 and multiplied it by 300, finding his average annual earnings to be $825. It was contended that as the decedent had not been employed to exceed 225 days at $2.75 his average annual earnings would be $618.25. Said the court: "In such case the commission is authorized to make an award based upon a computation whereby the actual daily wages shown by the evidence to have been paid the deceased as an employee in the class to which he belonged was multiplied by 300, or approximately, if not actually, the number of working days in a year."

In a Massachusetts case a deceased workman had been employed about two months at a weekly wage of $12. The court found that the average weekly wages of the deceased employee were $12. The Massachusetts act defines "average weekly wages" to "mean the earnings of the injured employee during the period of 12 calendar months immediately preceding the date of injury, divided by 52." The court disapproved of this definition for uncertainty.

The day rule is recognized and is in force in Illinois.

In a Michigan case the court said: "We are of the opinion that the legislature had in mind that in every employment the employees work more or less irregularly, and that the annual earnings of any employee shall be determined by taking 300 times the average daily wage or salary which the employee has earned in such employment during the days so employed. This was undoubtedly the best method that could be provided for compensating a person; for if the employee does not work often enough to satisfy his employer the employer has the option to discharge him. We see no error in the method adopted by the board in measuring the compensation."

Seasonal Occupations

Of course there are plausible points of criticism in this 300-day rule. The greatest criticism comes from employers who are engaged in operating their plants only for two or three months of the year, or in what is often termed seasonal employment.

Certain factories fall into this class and they can do business, due to the nature of the business itself, only for a portion of the time or at certain seasons. I might mention several of these "seasonal" occupations, but perhaps the best illustration that could be given is the canning industry. Canning factories, according to statistics, do not operate on the average more than 90 days in the year, and the great majority of them confine their activities to 60 days.

Should workmen in these occupations, in case of injury, be compensated according to the rate of having worked 300 days in the year? This would manifestly

be unfair to the employer, for he would oftentimes be called upon to pay as much in compensation under such a plan as he would ordinarily pay in wages.

The 300-day rule does not generally apply to this class of workmen, although it does by inference and direct decision in a few states. Many of the courts have said that a man working at a seasonal occupation shall be compensated upon the basis of the average weekly wages for the period actually employed, or that his average daily wages should be multiplied by the average number of working days in his employment and the result divided by 52 in order to find his average weekly wages throughout the year.

The matter is handled by many of the acts themselves in which it is provided that if a man works less than 300 days in the year, but not less than 200 days, that his working days shall be deemed to have been 300; that if he works less than 200 days that his working days shall be deemed to be 200 unless recognized to be less and the yearly earnings based on that figure although he does not in fact work that many days during each year.

It is a proposition which calls for a great deal of thought and consideration on the part of all concerned. The courts have, I think, struck a medium between two extremes which is as fair as any system that could be devised. The 300-day rule is the rule applying to 90 per cent. of the cases, and most computation should be based on it unless there is an express provision of the statute or of the courts to the contrary.

Good and Bad Features of System

By J. B. GRAY

It is of course self-evident that no one system can fit all conditions. In a good workable system every feature is interdependent upon every other feature, so that in modifying or rebuilding a system that has been found acceptable in one shop to fit another, especial care must be taken that the changed portions do not nullify or antagonize the original intent.

THE Taylor system has been widely criticised, but from the viewpoint of the shop it has many redeeming features. Many shops have adopted it, and while some have later discarded it, others have retained it. Because of these conditions it might be well to adopt a critical and speculative attitude toward systems in general until we get the opinions of the firms that continue to use them.

So far as my observations go, the principal objection in the shop seems to be over-systematization—a complex and intensive employment of symbols that the man in the shop cannot grasp. The fact that many large plants continue to use the Taylor system, and many others employ a modified form of this system, would indicate that it has many points of merit.

Many plants—some of them of international reputation—have endeavored to readjust and modify the Taylor system to make it apply to their particular shops with a minimum of additional clerical work and with the least friction with the shop, but in this modification they have discarded the really valuable and convenient features and retained only that to which the shopman objects; viz., the extensive system of symbolization. Moreover, as might be expected when such a system is readjusted by others than experts, it is quite likely to become unwieldy.

Symbols can easily be made intelligible to the shopman and at very slight expense; very much less than the cost of turning the man loose and leaving him to find out for himself. A real machinist, whether he be a specialist or an all-round man, finds no comfort in the "I should worry" idea until he has fallen down flat and hard in his endeavor to understand the system; even then, many mechanics will quit rather than struggle along with something that is entirely beyond their comprehension.

Again, when an attempt is made to remodel an extensive system, there appears to be a disposition on the part of the managers and other high officials to add a little here and there to what was originally intended. Of course each succeeding manager, etc., must add his bit—if only his initials—and as these officials are not in a position to see the matter from the viewpoint of the shop, these additions occur on the clerical end of the system. The result is eventually a system of symbols that even the superintendent himself cannot understand without constantly referring to his index.

When a system is remade to suit the real or fancied requirements of a certain shop by some one in the management, there is very apt to be a tendency to favor some departments with an oversupply of system while others are neglected to the point of having scarcely enough. As a result we have an unbalanced condition that can never be as efficient as it should be. For this reason we of the shops would prefer to see the Taylor or some other established system used in preference to any home-made substitute, provided there could be a modification and a clarification of the symbolical part.

A home-rebuilt system sometimes produces queer results and some large plants appear to be at one and the same time over-systematized and practically without system. I have in mind a large plant which will serve to show the fearful results of taking a perfectly good system and tinkering it up with the evident idea of transferring everything requiring any thought at all to the office, and attempting to make mere automatons of the men.

A board was ripped off the Taylor system here and there, and with this armful of second-hand lumber a raft was constructed upon which the firm embarked upon the troubled waters of business in search of the haven of efficiency. They soon discovered, however, that in the Taylor system every feature is dependent upon something else, but instead of throwing the whole make-shift on the scrap heap and starting over again, everybody concerned threw in a handful of symbols, and—perhaps in order to add a touch of color to life—there appeared cards of more colors than Joseph's coat

ever had. So complete did the system eventually become and so evidently unnecessary was the greater part of its provisions that neither men nor foremen were constrained to pay much attention to the rules and regulations.

On the part of the men this negligence was due to the same old over-symbolization to which I have referred before, while the foremen found it a physical impossibility to comply with all the requirements and have any time left to do anything else. The work comes to the departments in boxes, barrels or on trucks, accompanied by a white, a red, or a green card. A white card means "full order" and also gives the part number, number of pieces, order number, a description of the various operations, and the department numbers; everything being written in a more or less legible hand. A red card means that the accompanying pieces form only part of the quantity and gives the same information as the white card but in checking out the stock the white card must also be made out and the number of pieces actually sent through under the red card must be deducted from the full amount of the order on the white card. This last card is retained by the stores department until the order is completed, when the white card is sent along with the final section.

The Clerical and Shop Viewpoints

All this looks quite simple from a clerical viewpoint, doesn't it? And so it is; but let's look at it from the shop viewpoint:

A department may have 50 or 60 orders on hand, in barrels, boxes, and on trucks, and the first thing that meets the eye is a wilderness of cards; white, light red, dark red, light brown, green, etc. Before any work can be started every one of the white cards must be inspected to determine if it is a new order or the final section of some previous one. If the former, the work could be started anywhere, while if the white card indicates the final section of an earlier order it might be advisable to have it follow the first part of the order on a certain machine.

Having straightened out our white cards the next step is to count the pieces in each lot and O.K. the number. Should this count fail to agree with the number written on the job card, all work on this order must be stopped, the work reboxed, or rebarreled and returned to the preceding department for correction. This must be done no matter what the result may be on production, and no matter how badly the work is needed. "Them's orders."

But suppose the amount is found to be correct and the work is started; after a time it becomes necessary to move those parts that lathe No. 1 has finished to lathe No. 2 to begin the next operation. Before you move one of those pieces to lathe No. 2, you will kindly comply with the following regulations: A red card must be made out for lathe No. 2. This card will indicate the number of pieces transferred to No. 2 and will specify the part number, full number of pieces in the order, shop order number, the operation to be performed on lathe No. 2, and the department number; then, and not until then, can No. 2 go ahead.

Now, having disposed of our white cards, you may think we are ready to get under way; but not yet. Before all our machines are tied up, those red cards must be inspected to ascertain whether the card signifies the first part of an order that is urgently needed, or spoiled work that is to go to the reclaiming department, or defective material for the inspection department, or if it indicates spoiled work that is to be moved to the inspection department for final disposition. Having determined the foregoing points we can then get under way—but not before then, inasmuch as the orders are, literally, "system first; production next."

Those who think in a hurry may conclude from the foregoing that I include the system and management of this shop in a general condemnation, but such is far from the intent of this letter; we have better and infinitely more important things to consider. When a lathe is not delivering its quota of production should I rush to my desk, write a treatise on how to run a lathe, send it to the office to have it O.K.'d and deliver it to the lathe hand a few days later? Would it not be better to deal directly with the lathe hand and concern myself immediately with the incoming of raw material and delivery of the finished product to the shipping room? Is there no virtue in deducing the cause from the effect and going direct to the lathe hand, investigating the difficulty in a frank way, and by making his problems mine induce him to make my difficulties his?

Confidence is and always will be the foundation stone of business; we can do nothing at all except we trust and depend upon someone, and it will injure me not at all to explain to John why I want that drill-jig in a hurry; if I want James to put through several lots of work in the least possible time, I would devote more attention to his speeds and feeds rather than try to mystify him with a mass of formulæ and I could—I think—indicate the succession of work and the order of operations in a way which he could readily understand.

Mystifying and puzzling men with complexities and symbolization will tend to create confusion; elaborate systems are apt to be the harbinger of chaos.

Of course since we must have system we must accept and use its symbols; but as in algebraic formulæ, the value of a character is given so why not expend a little time and a little money in educating the men of the shop to the value of each symbol in the system, as an intelligent business proposition, tending to draw men and management a step closer to that condition of mutual consideration and coöperation that would enable us to meet competition secure in the conviction that our men are behind us, beside us and all around us, every ready to lend a hand where it will do the most good.

Money is not everything. I have found that the shops having the smallest labor turnover are not at all the shops paying the highest wages, but rather the shops that have really and honestly tried to understand the men and succeeded in so doing. Some of these shops are high-speed system shops too.

How Would You Prevent This Grinding Trouble?

By A. E. Robinson

In reply to the query of John Vernon on page 705 of the *American Machinist*, I would suggest that he cut the cold-rolled steel into suitable lengths and heat them slowly to incandescence (just under the scaling point) and let them cool slowly. Assemble the parts as usual, taking care to avoid peening action when riveting on the bracket, and grind the surface on a wet grinding machine.

The Manufacture of Semi-steel Shells

By E. A. Suverkrop
Associate Editor *American Machinist*

EARLY in the world war Germany began to use cast-iron shells for war purposes. Many fragments and whole shells were collected by the Allies, and if my memory is correct an article was published in a British technical journal early in 1916, giving a detailed account of these German cast-iron shells together with their analysis. In that same year photographs were brought to this country, and published in the *American Machinist*, which showed some of the manufacturing operations on German cast-iron shells. As every one knows, semi-steel is pig iron with a percentage of machinery or structural steel scrap. The resultant metal to the layman looks like ordinary cast iron. Practical foundrymen differ widely in their opinions of it. Averaging up statements made to me by a number of competent men, semi-steel, if properly mixed and poured, has greater tensile strength than ordinary cast iron but in structure both are so similar that they cannot be easily distinguished from each other.

Machine chips from semi-steel seem to be a little tougher and to have a little more "curl" to them than ordinary cast-iron chips. In one large shop where lathe castings are made of cast iron with an addition of about 20 per cent. of low-carbon steel, the planing machines are run at 50 ft. cutting speed, and the only noticeable difference on the finished work is that it is not so dark in color as ordinary cast iron. Tools used on these semi-steel castings require regrinding about as often as they would on cast iron. According to "Kent's Mechanical Engineers' Pocket Book," "Semi-steel is a trade name given by some founders to castings made from pig iron melted in the cupola with additions of from 20 to 30 per cent. of steel scrap. Ferro-manganese is also added either in the cupola or in the ladle. The addition of the steel dilutes the silicon of the pig iron and changes some of the carbon from graphitic to combined carbon, but the total carbon is unchanged, for any

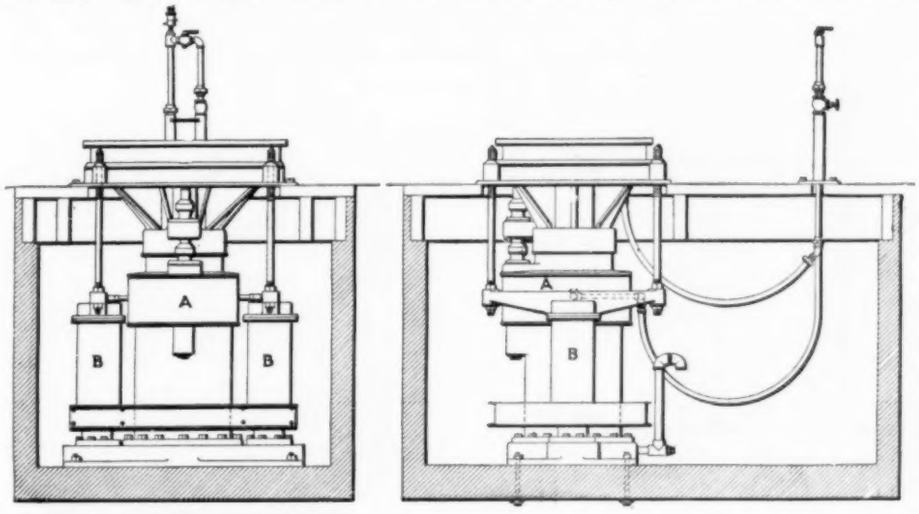


FIG. 1. SHOCKLESS JARRING MACHINE ADAPTED FOR MOLDING SHELLS

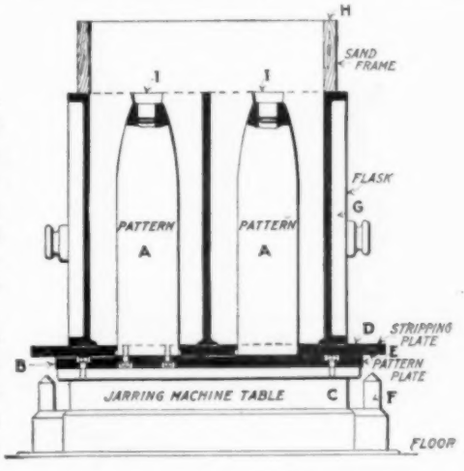


FIG. 2. MOLD READY FOR JARRING

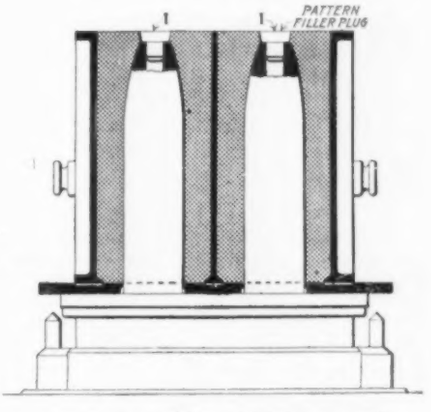


FIG. 3. MOLD "STRUCK OFF" (AFTER JARRING)

ARMY ORDNANCE NEWS

reduction made by the steel is balanced by absorption of carbon from the fuel. Semi-steel therefore is nothing more than a strong cast iron, low in silicon and containing some manganese, and the name is a misnomer."

Up to the present no data are available as to its strength under compression, but cast iron has a strength of about 80,000 lb. per sq.in. as opposed to 60,000 lb. for structural steel. This being the case, there is no reason why semi-steel or even good cast iron should not be used for projectiles, for the stresses to which the projectile is subjected by the propulsive charge are compressive. Practice shells of cast iron have been used by the United States Army for many years. These were cast in comparatively small quantities by ordinary foundry methods in a three-part mold, i.e., cope, cheek and drag. This was perfectly satisfactory for the small numbers of shells required for practice, but when it came to supplying them by the million there were and are not enough skilled molders to supply the molds. Appreciating this and the fact that the molder abhors a three-part mold the Tabor Manufacturing Co., Philadelphia, Penn., has devised a method whereby these shells can be turned out in large quantities by a machine-molding process which at most requires only the services of semi-skilled help. Further, this method discards the cope and drag of the objectionable three-part mold and retains the cheek only. Regarding the speed of production it is estimated that two or at most three men with one of these machines can put up 175 flasks of four molds each a day.

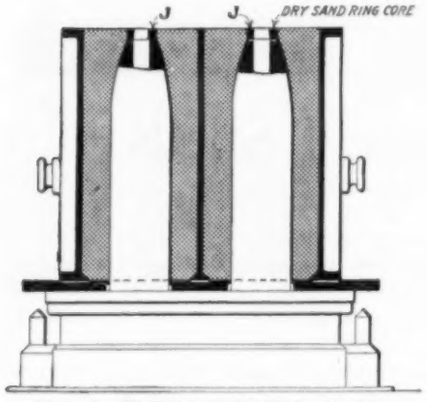


FIG. 4. PLUGS REMOVED, RING CORE SET

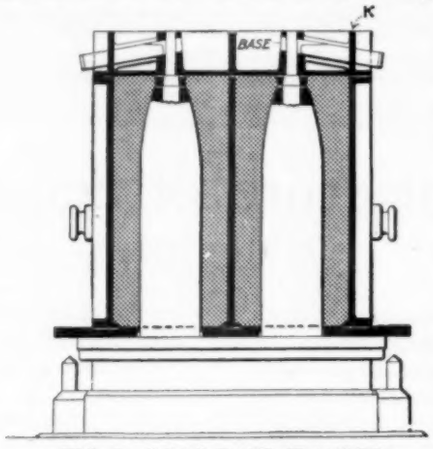


FIG. 5. DRAG BASE CLAMPED ON FLASK

Fig. 1 shows two views of the machine. At *A* is a standard shockless jarring machine. At *B* on each side of it are the pattern-stripping cylinders the piston rods of which raise the flask after it has been rammed and strip the molds from the four patterns. The operations necessary for molding four shells are illustrated in Figs. 2 to 9. Referring to Fig. 2, the four patterns *A*, only two of which are shown, are secured with capscrews to the pattern plate *B*, which is firmly bolted to the jarring machine table *C*. On top of the pattern plate is the stripping plate *D* which embraces the patterns *A*. At each corner of the stripping plate and on the under side of it is a conical depression *E* to center the conical ends *F* of the piston rods of the stripping cylinders. With the patterns and stripping plate in place wooden plugs *I* are placed in the holes in the tops of the patterns, the flask *G* is positioned as indicated, and on top of it the wooden sand

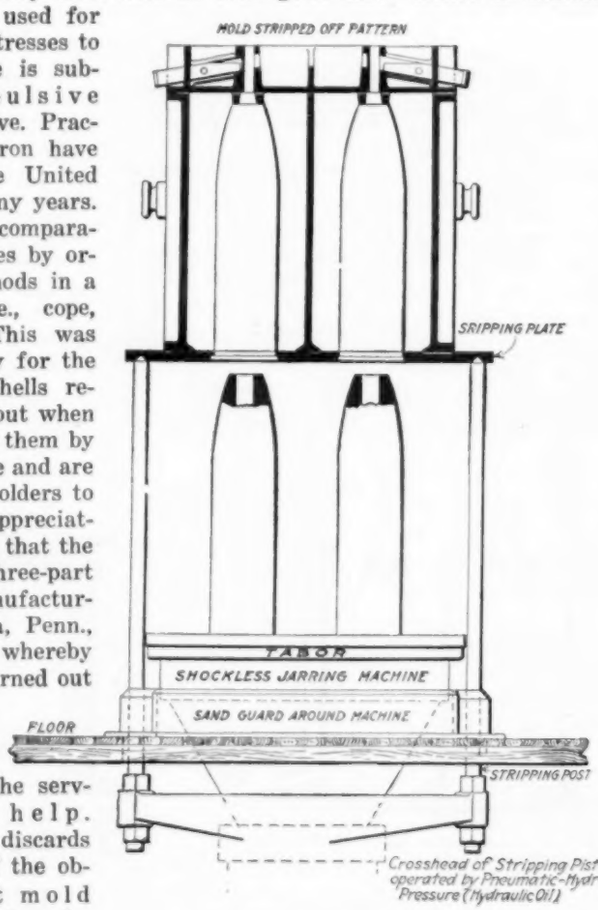


FIG. 6. MOLD STRIPPED OFF PATTERN

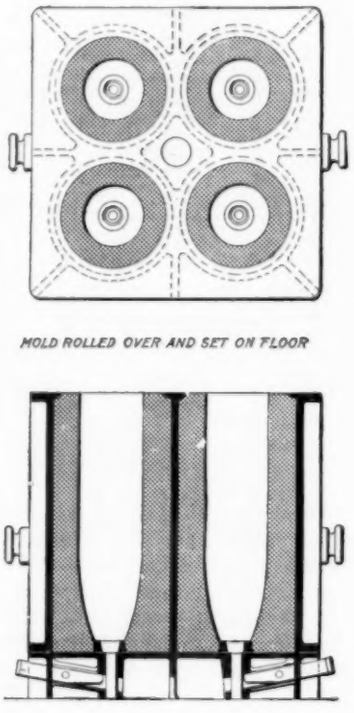


FIG. 7. MOLD ROLLED OVER AND SET ON FLOOR

ARMY ORDNANCE NEWS

frame *H*. Molding sand is then shoveled in and the jarring machine started, after which the sand frame is removed and the top of the mold struck off as shown in Fig. 3. The wooden plugs are then removed and in their places are put the dry sand-ring cores *J*, Fig. 4. With these in place the drag base *K*, Fig. 5, is clamped on the flask, the stripping mechanism is operated and the flask, molds and stripping plate pushed up clear of the patterns as shown in Fig. 6.

The mold is then rolled over as illustrated in Fig. 7 with the drag base *K* down. In the meantime the cores *L*, Fig. 8, have been prepared. They are made around a central pipe, which is provided with perforations and has a piece of burlap wrapped around it. The cores are set as shown in Fig. 8. At the lower end the core rests on a collar *M*, the machined face of which rests on the machined face of the drag base. These collars are forced to a secure seat by means of the wedges *N* entering the slots in the central pipe on which the core is formed. A single tap with a hammer secures each core.

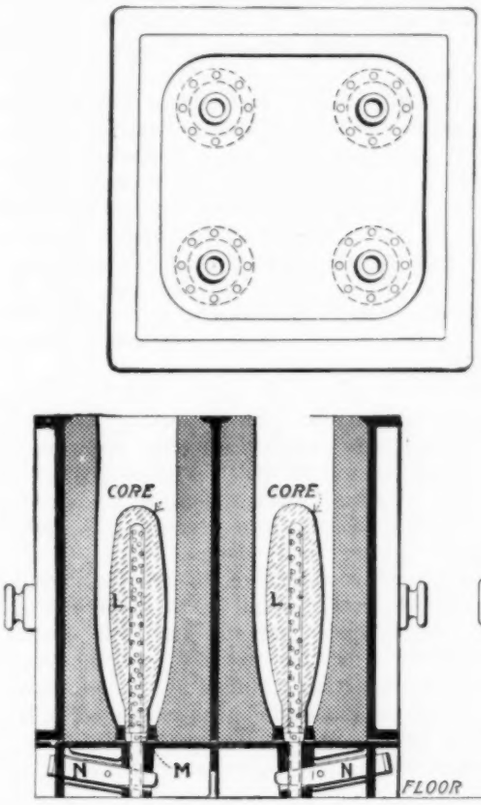


FIG. 8. CORES SET AND ARBOR WEDGED IN BASE

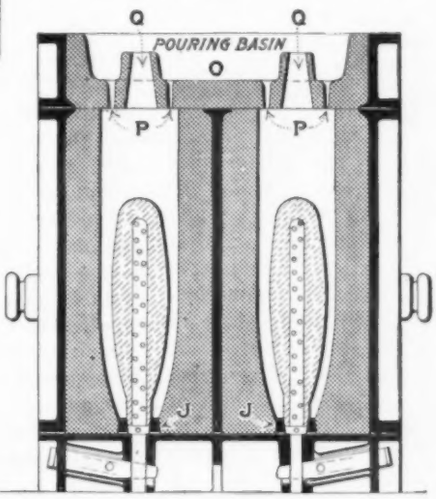


FIG. 9. MOLD READY FOR POURING

With the cores set, the pouring basin *O*, Fig. 9, is placed. The clean metal enters the molds through the small openings *P*. Falling to the bottom of the mold it strikes the dry sand-ring cores *J*, which, because of their hardness (as compared with green sand), hold their shape. The pourer watches through the holes *Q*, and when the metal is about an inch from the top of the cheek no more metal is poured into the pouring basin; thus there are no sprues to cut off.

The Government specifies the mixture that shall be used and also the depth of metal that shall be cast above the top of the core. The reason for having such a thick base on the shells is to assure sound metal at this point, so that there will be no pipe or other fissure through which the fire from the propulsive charge can be communicated to the explosive charge contained in the cored center of the projectile.

PERSONALS

Maj. Charles B. Going was discharged on his return from France after 18 months service. During his entire service he has done editorial work on the Ordnance Encyclopedia and on various histories of the Ordnance Department in the A. E. F. He is a graduate of Columbia University and before entering the service edited and managed the magazine and book publications of the Engineering Magazine Co. His permanent address is Salmagundi Club, New York City.

* * *

Col. John R. Simpson, 278 Waverly Ave., Newton, Mass., has returned to civil life after about 22 months of service, both in the United States and with the A. E. F. While with the A. E. F. he was in charge of liquidation of Ordnance Department contracts in Great Britain, and during the last month of his service, was a member of the Board of Liquidation for the A. E. F. He is a graduate of Williams University and before entering the service was with William Filene's Sons Co., Boston, Mass.

* * *

Lieut.-Col. Jess C. Jurgenson, 1733 Q St., N. W., Washington, D. C., has been discharged. While in the service Colonel Jurgenson was in charge of the Instrument, Machinery and Container Branch, Inspection Division. He attended the Danish Royal Technical Institute for four years. Previous to entering the service he was general mechanical superintendent and purchasing agent for five mills of the United Piece Dye Works, Lodi, N. J.

* * *

Lieut.-Col. Seth K. Chase was discharged on his return from France. He was appointed Major in January, 1918. Colonel Chase has been Assistant to the Head of Aircraft Armament Section, O. D. He will be associated with the Peoples Gas Light and Coke Co., Chicago, Ill., as he was before entering the service. His permanent address is 122 South Michigan Ave., Chicago, Ill.

Proposed Increased Efficiency in Patent Office

SPECIAL CORRESPONDENCE

Nearly one million, three hundred thousand patents have been granted by the United States Government through the patent office. Imagine if you can the tremendous amount of documents that must be looked over by the examiners before they can decide whether the inventions upon which applications for letters patent are before them are new and patentable, and whether there are other applications on file or patents in existence that will interfere with them. For many years the patent office has been notorious for its inefficiency, and any reforms that will put it on an efficient basis will be welcomed by all having to do with patents.

EMPLOYEES of the United States Patent Office have organized under the name of the Patent Office Society for the purpose of advocating certain reforms in the administrative branches of the department, which, it is claimed, will bring about a higher efficiency in the system. Committees on legislation and publicity have been appointed with the view of educating the public to the necessity for an immediate improvement of the present patent-office system and to push Congressional enactment to broaden the scope of the department.

What the Plan Includes

The plan includes the separation of the patent office from the Department of the Interior and provides for an executive officer who shall be an industrial and efficiency expert, the position to eventually be that of a Cabinet officer when the department shall have assumed the proportions to warrant such a distinction. The main contention is that the patent office is distinct from the Department of the Interior in its administration and functions and that no progress can be made until a separation is effected. A lack of close affiliation appears, it is claimed, from which the patent office must necessarily suffer in matters of proper appropriation for maintenance and expansion, and for many other reasons.

The views of the society have been set forth by James H. Lightfoot, the examiner of the patent office, in papers presented by him before the examining corps of the department. Mr. Lightfoot makes the following assertions regarding the inefficiency of the present patent system:

1.—That all patents granted are still merely prima-facie evidence of the rights of inventors to their invention, whereas the grant itself and the Constitution provide for the grant of unconditional, secure and exclusive rights.

2.—That although the statute (4886) requires, as a condition precedent to the grant, that the alleged invention sought to be patented must have been in fact invented, patents have been granted and are still granted for things not invented because of insufficient time and inadequate facilities for the proper consideration of this important question, and patents have been and are still refused because of the want of the proper system requiring the presentation of practical evidence indicating invention, for the consideration of the examiner.

3.—That although the statute requires, as a condition precedent to the grant, that the alleged invention sought to be patented must be new, patents have been granted and are still granted for things not new.

4.—That although the statute requires, as a condition precedent to the grant, that the subject matter sought to be patented must be useful, and under statute (4893) that it must be "sufficiently useful and important," patents are still granted for theoretical and sometimes practically useless alleged inventions, which have later constituted bars to the grant of patents to inventors of real inventions that would have practically promoted the industrial arts.

5.—That although the statute (4886) requires, as conditions precedent to the grant, (a) that the alleged invention must not have been known or used by others in this country before the applicant's invention or discovery thereof; (b) that the alleged invention must not have been in public use or on sale in this country for more than two years prior to the application; (c) and that the alleged invention must not have become abandoned. Patents have been generally granted without any investigation of these important questions affecting validity.

6.—That although the revised statute (4903) requires that helpful information be furnished to applicants to aid them in obtaining proper protection, patents are still granted the claims of which are so limited in scope as to be valueless to the inventor for want of a uniform standardized system of examining the applications.

7.—Although the provisions of the revised statute (4904) provide for notice in all cases of interfering applications and patents, patents are still granted which are rendered practically valueless and the industries based thereon practically ruined by the subsequent issuance of interfering patents granted on copending applications of which the former patentees had no statutory notice during the copendency of such applications.

8.—That patents are still litigated in courts which, with some few able exceptions, are not specially qualified promptly and properly to determine the technical questions arising under the patent laws.

In order to remedy these defects in the patent system, it is necessary, according to the Patent Office Society, that the patent office, which is charged with the duty of providing safe and sound titles to industrial property, must be given the status of an independent, enlarged, modernized, industrially efficient institution in order that it may perform its work thoroughly and yet with a promptness that will be of benefit during the reconstruction period. Under the present system, it is stated, the development of inventions and industries based thereon is stagnated.

Mr. Lightfoot recommends in the reorganization of the patent office the establishment of five bureaus, namely, Bureau of Information and Education, Bureau of Patents and Publications, Bureau of Utility, Bureau of Validity Examinations, and Bureau of Priority of

Inventions. These recommendations have been approved by the Patent Office Society.

The functions of these bureaus are described by Mr. Lightfoot as follows:

The Bureau of Information and Education should be equipped with men and full facilities for promoting the dissemination of knowledge of the true meaning and provisions of the patent system. Especially is this essential because in its most fundamental sense the patent system is an industrial educational system and it constitutes one of our most glaring national errors that the public in whose interests the patent system was established has been kept in ignorance of its true meaning and intent.

This educational bureau should be charged with the duty of establishing a system to instruct the inventing public as to how to prepare to make inventions, how to invent in the interest of the public and with profit to themselves, what to invent, how to avoid losses through abandonment or want of knowledge as to how to proceed after conception or reduction to practice to avoid complications, how to obtain patents of value, how to study the prior arts before inventing, how to select competent attorneys; in fact everything connected with making, patenting and marketing inventions, just as the Department of Agriculture has, through bulletins, publications and field agents, instructed the farmer in all respects how to prepare to produce crops, how to produce them, how to protect and conserve them when produced and how to market them in the most efficient way.

A Great Need of Educational Work

The incalculable values in time, money and energy that have been wasted in inventing useless things, in reinventing things that have been shown to be old, and the great values in inventions lost to the nation because the inventors have not known how to properly develop them to material form and how to have them properly disclosed and protected in letters patent, clearly indicate the great need of educational work along these lines.

Included in this educational bureau may be a corps of patent field agents, just as there are agricultural, land and pension field agents, who in coöperation with inventors, attorneys, manufacturers and capitalists, should seek to aid, in every possible way, the interests of inventors and manufacturers, because in this way the public interests will best be subserved.

The Bureau of Patents and Publications should have an able staff of men to establish and maintain an efficient classification of patents and an efficient classified library of all statutory publications relating to the industrial arts. This staff of specialists should properly digest publications for quick and thorough search purposes. It should by a regular standardized system seek to procure industrial literature from manufacturers and from all other sources and should classify and systematize them for ready research purposes.

The Bureau of Utility should be equipped with laboratories, and all necessary equipment and competent workmen who will coöperate with the examiners in accurately determining, before patents are granted, the practicability and operativeness of alleged inventions under consideration.

The Bureau of Validity Examinations should be fully equipped with well-qualified men, including an additional grade of reëxaminers to reëxamine claims held allowable by other assistant examiners this new grade ranking between the first assistant and principal examiner. The work of this corps of specialists should be so systematized and arranged that each should have full time and facilities to examine the subject-matter of each application under his consideration thoroughly, from the standpoint of the public, so that, when granted, patents may afford the inventors full protection and be essentially valid. This would constitute a safe and sound basis for the establishment of industries, and safe and secure investments for the capitalists who may promote the establishment thereof.

The present divisions of interference should be expanded into a Bureau of Priority for the full, complete and final determination of the question of priority between copending applications and patents containing common patentable subject-matter. It is essential to the establishment of safe and secure rights that the question of priority be promptly, thoroughly and finally determined within the bureau, and that this question be not extended through various appeals in the patent office and then further and indefinitely extended through various appeals in the courts. With a competent and efficient Bureau of Priority the questions at issue may be fairly and finally determined by judicial officers within the bureau, it being a matter of much importance that the patents when granted be free from further complications if they are to constitute bases for the establishment of industries, or if they be importantly involved in an industry already established.

The injury to established industry and the discouragement to inventors, manufacturers and investors due to the subsequent grant of patents that dominate or invalidate patents formerly granted on copending interfering applications without notice, have created a condition so obviously violative of the grant of secure and exclusive rights that distinct reforms should be effected. As it is essential to a safe and sound industrial system that patents be granted that are essentially valid in view of the prior published arts, so it is also equally if not more essential to such safe and sound industrial system that patents, when granted, be free from further interference by domination or invalidation by copending later granted patents of which the former patentees had no notice while their cases were pending.

This greater and broader department of invention and discovery may possibly also include a Bureau of Licenses and Sales, just as the Department of Agriculture has a Bureau of Markets.

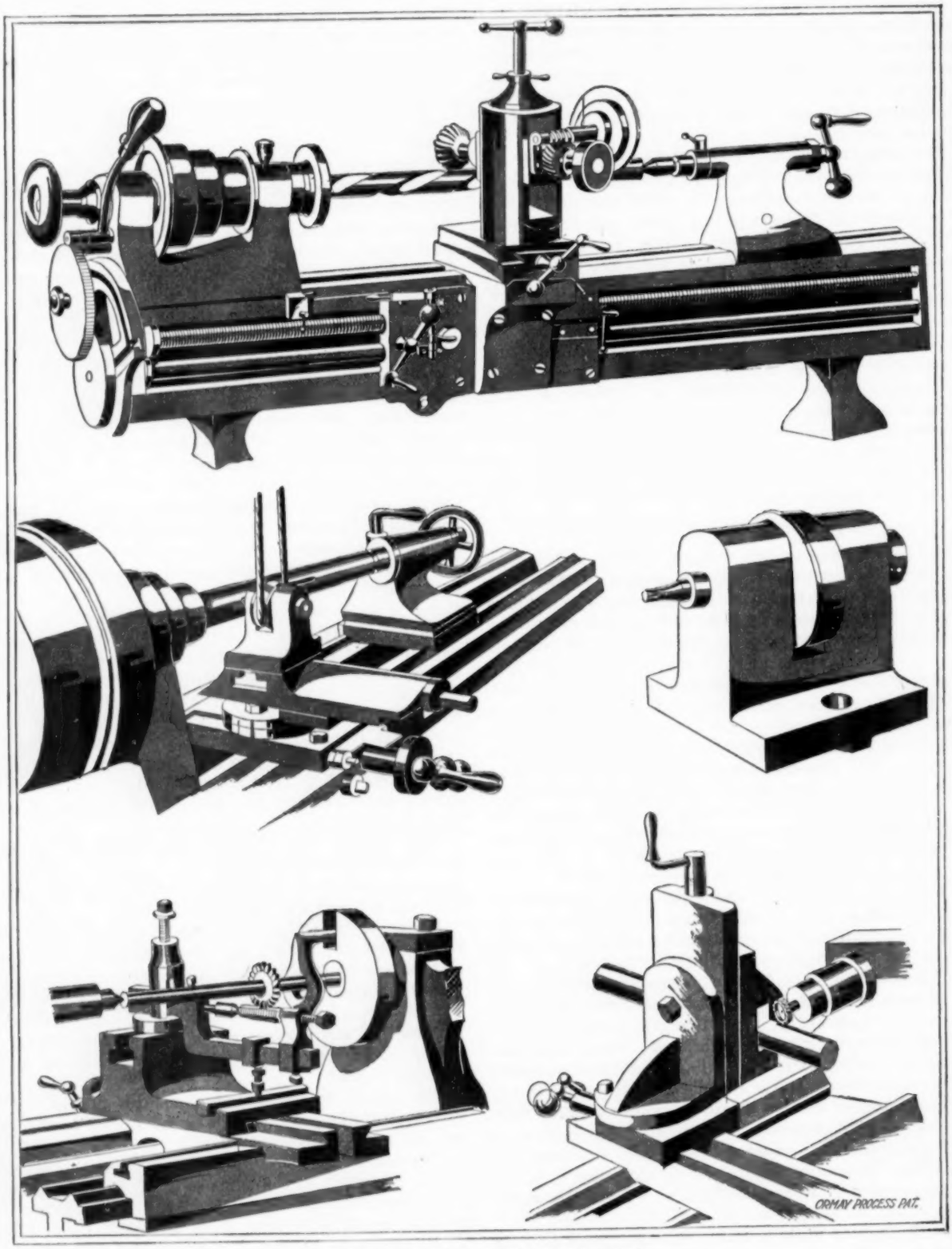
It was explained by the members of the Patent Office Society that the patent office is an independent bureau, and, backed by the interests of the country, could obtain a million-dollar appropriation from Congress where now the commissioner acting alone and given a merely perfunctory hearing as one of the bureau chiefs, can obtain an appropriation of but a few thousand dollars or none at all.

The society is publishing a monthly journal in the interests of the principles being advocated in the reorganization of the patent office.

The officers of the society are as follows: President, M. H. Coulston; vice president, J. H. Lightfoot; secretary, Bert Russell; treasurer, W. F. Avery; executive committee, A. W. Cowles, E. S. Glascock, G. A. Lovett, C. H. Pierce, M. E. Porter, E. D. Sewall, W. L. Thurber, W. J. Wesseler. The business manager of the journal is W. J. Wesseler.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



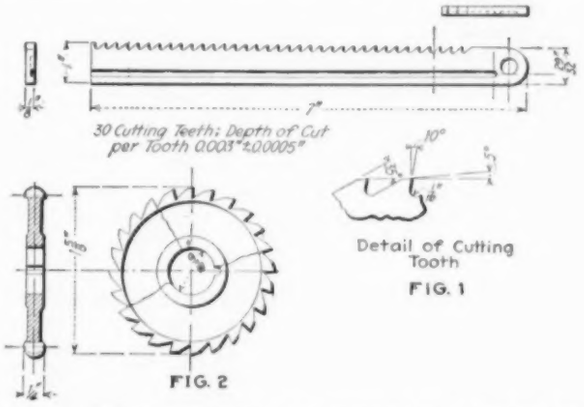
MILLING ATTACHMENTS FOR LATHES

Hardening Broaches and Cutters

By J. B. Gray

Sometimes it happens that a departure from the standard methods of hardening can be used to advantage—in fact, it is necessary. The two sketches illustrate instances where the old principles of even heating and cooling were disregarded to our very great advantage.

Fig. 1 shows one of a set of six broaches used to produce a slot $\frac{1}{8}$ in. wide by nearly 1 in. deep. After



FIGS. 1 AND 2. BROACH AND CUTTER FOR KEYWAYS
Fig. 1—The broach. Fig. 2—Cutter for circular keyway

the slotting is completed, the piece is hammered around a "formed piece" under a power hammer, producing finally a slot about $\frac{1}{32}$ in. wide, and of irregular contour, somewhat similar to the keyhole in a Yale lock. The vital part of the broach is the groove shown at *A* which acts as a guide and obviously must be fairly true.

We had much difficulty for a while to harden broaches of this type satisfactorily, as they would spring despite the utmost precautions, even when we tried a steel of low-carbon content, and resorted to pack-hardening. Grinding to correct errors due to hardening is impractical, owing to the size and the length of the groove, although the cutting teeth must be ground. We found the best method of hardening was to harden only the cutting teeth, and to leave the rest of the broach soft. This was done by placing the broach in a roll of fireclay about 2 in. in diameter and allowing only the teeth to be exposed. After heating, the whole affair was placed in the quenching bath where the fireclay kept the water from contact with the broach except at the cutting edge. The broach was kept in this bath until quite cold, no attempt being made to "draw" the teeth.

The cutter in Fig. 2 presents quite a different proposition; this is known as a "gashing cutter" and is used to mill a keyway in a ball yoke, to receive a circular wire key for retaining the journal bushing used in motor-truck manufacturing. The cut is straight in, and is very similar to "sinking" a keyway for a Woodruff key. This imposed a great strain on the cutter and the usual breakage averaged about 10 or 12 a day, and since these cutters cost about $3.75 each, we thought the situation sufficiently serious to warrant us in trying to find a solution.

In the first place, the operation is in steel drop-forgings. We found that the density of the metal varied through forging after the piece became too cold or showed hard spots because the piece was thrown out on the damp ground while still hot. As it was practically impossible to eliminate these conditions, we tried grinding the cutters in various ways, such as staggering the teeth; shearing alternate teeth; undercutting the radial faces and back-raking the same faces, but failed to obtain satisfactory results, as the cutters continued to break. Usually the fracture would be as shown in Fig. 2, but sometimes the break would occur through an entirely different part of the cutter and then it might develop anywhere.

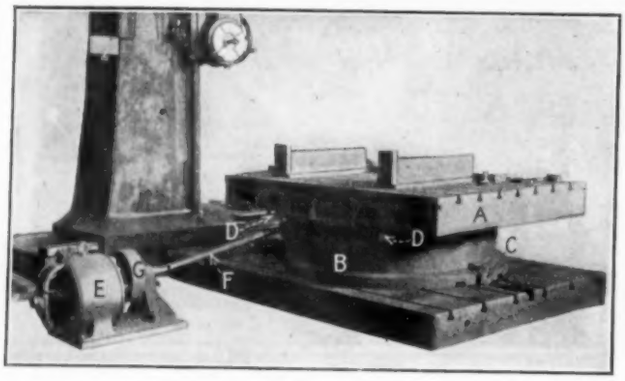
It was this "across center" breaking that gave us an idea, so after hardening we tried heating a piece of rod to a yellow heat and placing the cutter on it; proceeding to draw the hub to a dark straw color, and quenching it as a straw color appeared on the sides of the cutting teeth. This effectively put a stop to the breaking, and one cutter, so treated, has run for three or four days and milled from 400 to 600 pieces before being scrapped.

With the center and web so drawn the worst we have to contend with, when we get a hard or "spotted" piece, is a broken tooth or two, or a dulled cutter, where formerly we lost the cutter altogether.

A Power-Driven Revolving Table for a Milling Machine

By J. V. Hunter

In the shops of the Cincinnati Planer Co., Cincinnati, Ohio, is a large Landis vertical-column milling machine which is extensively used for boring large bearings in heavy housing castings. As these bearings are bored at right angles to one another, it was necessary to shift these heavy castings after the first set-up and reset them at 90 deg. from the original position in order to make the second boring. Since the shifting required considerable time, a special motor-driven re-



REVOLVING TABLE PROVIDED FOR A MILLING MACHINE

volving table was built and set on the main bedplate of the Landis milling machine in order that the castings could be turned at right angles without necessitating re-setting and leveling.

The revolving table *A*, shown in the illustration, is plentifully supplied with T-slots for holding down bolts in its top surface, and is webbed and of sufficient depth to afford ample stiffness. The table revolves on the special base *B*, which is keyed to the main base of the milling machine in the slot *C*, in order to prevent shifting during the various operations. The upper table can also be clamped to the flange of the base by means of the clamps at *D*, and means are provided so that the workman can determine when the table is revolved to the required position. The reversible motor *E* furnishes the power for revolving the table. This motor is geared to the connecting shaft *F* and has a drive pinion which runs inside of the internal spur gear *G*. The connecting shaft is provided with two universal joints and one expansion slip joint.

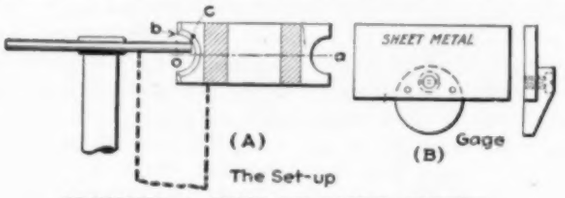
The table is revolved by means of a worm-gear drive and is provided with wide bearing surfaces situated near the outside edge. A center-bearing pivot sleeve is also provided as a long bearing through the center of the base housing.

Grinding a Half-Round Concave Milling Cutter

By Adolph Moses

Any one who has read the catalogs furnished by the makers of radius-cutter grinding machines has had their attention arrested by the fact that in giving the capacity of such machines it is stated that they will grind somewhat less than a semicircle on concave cutters. It is for this reason that the usual method of making a concave-faced cutter to embrace a full half-circle is to make it in two interlocking parts. Now it is ordinarily quite a feat to grind the halves of an interlocking cutter so that when they are placed together they will cut a true semicircle, but the use of the following method makes the job fairly easy:

Place the cutter on the grinding arbor and set the machine so that the wheel will occupy the position as shown at *A* in the cut, with the wheel just off the center line *oa*. If an interlocking cutter is to be ground, whatever packing may be necessary is put in place and the two halves fastened together, it being treated thereafter as a single cutter. It will now be easy to grind more than a quarter of a circle on each tooth starting from the point *b* and using the surface *c* of the wheel to do the grinding.



GRINDING A CONCAVE-FACED CUTTER

Next shift the wheel to the opposite side of the line *oa* till it just touches a part of the radius already ground and complete the semicircle on all the teeth. It will be very convenient to use a small gage like that shown at *B* to insure accurate results. As a true semicircle is our goal, care should be taken to see that the radial face of the tooth being ground is level, the desired clearance being obtained by having the face of the tooth the proper distance below the center of the wheel.

A point that should be kept in mind in all radius grinding is that there are two essentials; first, to locate the center about which the radius is ground; and second, to get the radius of the correct length. In the sketch the point *o* is the axis about which the cutter swings, thus it is the center about which the radius is ground. It is located properly by moving the cutter with respect to this point.

The second requirement of getting the correct radius is satisfied by moving the wheel with respect to the axis *o;* the farther the cutting edge of the wheel is from this axis the longer the radius. To put it briefly, the degree of curvature is varied by moving the wheel with respect to the axis *oa*, while the location of the curve is varied by moving the cutter with respect to the center *o* about which it swings while being ground.

Laying Out Intermittent Gears

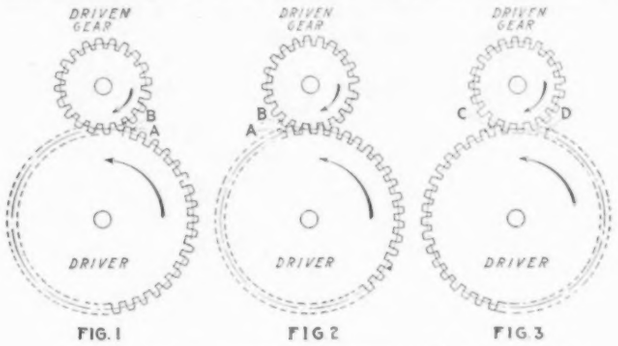
By S. H. Yorks

The design of intermittent gearing presents some peculiarities that are not met with in ordinary gear problems and which must be taken into consideration in order to obtain the desired results. For instance, in an ordinary gear train where it is desired to rotate the driven gear a given number of turns for each revolution of the driver, the relative numbers of teeth in the gears are proportional to the number of revolutions. This does not hold true with intermittent gearing.

A common form of intermittent gearing illustrating this point is where the driven gear is rotated through one complete turn during a part of a revolution of the driver. A pair of gears laid out to give this effect is shown in the accompanying illustrations. It would appear at first glance that in this case the two gears would have the same number of teeth, but on actually laying them out it becomes apparent that the driver must have less teeth than the driven gear.

Starting with Fig. 1, the first tooth *a* of the driver which is shown coming into mesh with the teeth of the driven gear after a period of rest continues in mesh until it reaches the position shown in Fig. 2. In other words, this tooth has the effect of carrying the tooth *b* of the driven gear through a distance equal to three times the circular pitch. This action of each tooth on the driver in carrying the driven gear through a distance greater than one circular pitch must

be taken into account in determining the relative number of teeth of the gears. In the example shown, the number of teeth on the driver must be two less than the number on the driven gear, in order to rotate the latter through one revolution. This point will become apparent by reference to Fig. 3, which shows the last tooth *c* of the driver coming out of mesh with the teeth of the driven



FIGS. 1 TO 3. INTERMITTENT GEAR LAYOUT
Fig. 1—First tooth engaging. Fig. 2—First tooth leaving. Fig. 3—Last tooth leaving

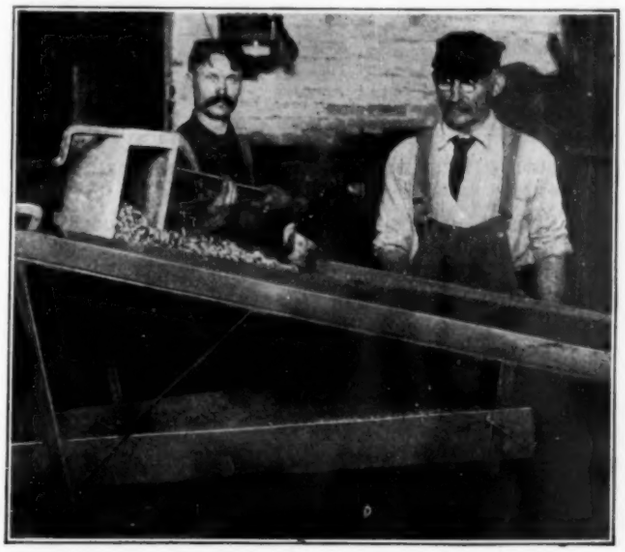
gear. The effect of this tooth has continued from the position *d* through three circular pitches to its final position *c*, making it necessary to have two less teeth on the driver than on the driven gear.

In designing gearing of this type, the exact number of teeth required on the driver must be determined by laying out the gears in the various positions indicated. In cases where the pitch chosen is such that the result is a fractional number of teeth in the driver, the pitch must be changed until one is found that will give a whole number of teeth.

Sifting Out Bone Ash

BY PETER F. O'SHEA

A sifter used in the hardening room of the Greenfield Tap and Die Corporation for saving bone ash after carbonizing is shown in the illustration. The top is a screen made from ¼-in. iron rods in parallel rows, fastened through supports at each end. A diagonal partition made of a strip of iron makes two compartments on the screen, each of which narrows down to a throat so as to act as a chute for the bolts



DEVICE FOR REMOVING AND CATCHING BONE ASH

or screws that are dumped into a box after the ash has passed from them.

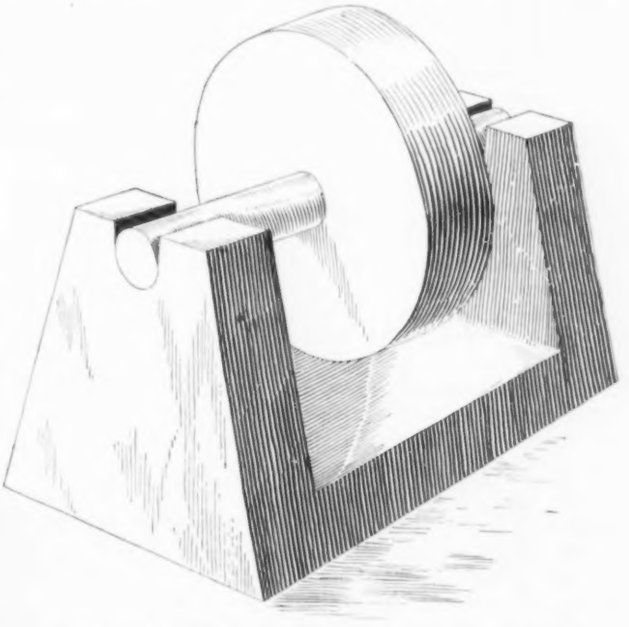
Below the sifter is an iron coal chute leading down to a box that is to catch the bone ash. This is found to be much better than letting the ash go through on to the floor where a breeze may blow it about and spread it everywhere. Hot bone ash or dust on the floor heats up everyone's feet, especially in summer, and those who have experienced it know that the worst heat in a hardening room is that which comes from the floor through the soles of one's shoes.

The bone ash, after it is entirely used up for carbonizing purposes and has begun to turn white again, is collected and sold back to the firm from which the fresh bone ash was purchased. The salvage price is now $20 a ton, which is one-third the price for new bone. This is a large percentage of salvage, but the manufacturer is glad to get back the material for use in making fertilizer.

Standard-Size Blocks vs. Limit Gages

BY F. C. HUDSON

In spite of the increasing use of limit gages there are a number of factories who still use the micrometer, believing that it has many advantages aside from the decreased cost. One of the great objections to the limit gage is that the operator has no warning



STANDARD SIZE BLOCK FOR SETTING "MIKES"

as to how much material is to be removed, as with the use of the micrometer or the spring caliper.

One concern which is noted for high-grade automobile work uses standard-gage, or caliper-setting blocks, as shown in connection with micrometers for many of their parts.

These standard-size blocks are mounted in the frame, and checked out from the tool crib by the operator, to be used in setting his micrometer. This does away with any inherent inaccuracy in the micrometer, or, if need be, allows the use of spring calipers, as the measurement in any case depends upon the sense of feeling.

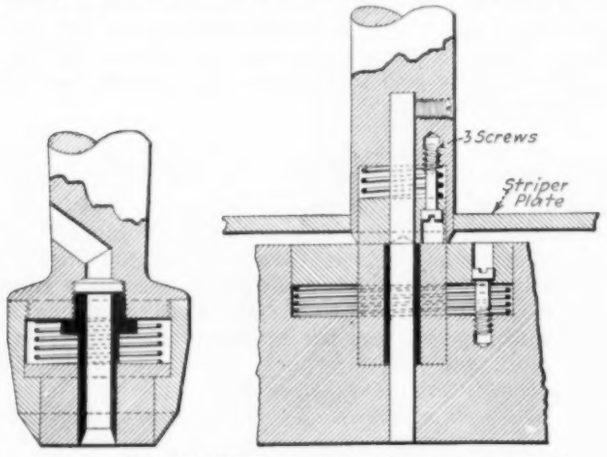
Another objection to the use of snap gages is that

they are apt to be sprung by different operators and the use of standard blocks and micrometers has been found much more satisfactory. There is evidently much to be said on both sides, and it is quite probable that the character of the work must also be considered in determining when limit gages are to be used.

A Hand and a Power Punch for Rubber Disks

By S. B. Royal

The illustrations show two excellent forms of punches for blanking rubber disks with a hole in the center in one operation. One is for a power press and the other



TOOLS FOR BLANKING AND PIERCING RUBBER

is a hand punch to be used on a wood, leather or other suitable block.

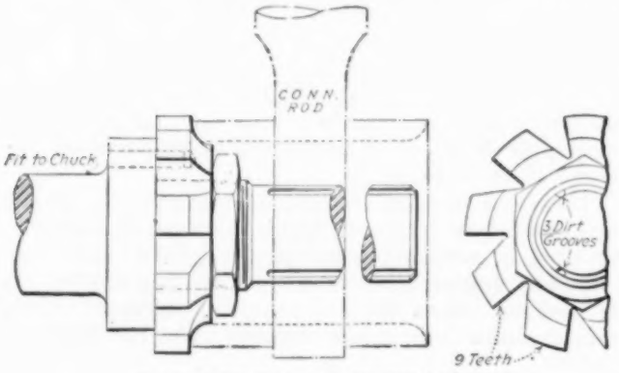
The method of operation is obvious. Rubber should always be worked wet either with water or preferably with some thin cutting compound of such nature as will not cause the tools to rust.

A Corner-Rounding Tool

By C. H. Dengler

The accompanying drawing represents a tool that is as practical in application as it is unique in design. Its function is to round the corner of the babbitt in the connecting-rod of an airplane engine. Formerly a single inserted blade was used but this type of tool required constant attention or the corner would lose its shape and interfere with the fillet on the crankpin; then trouble would begin. This tool maintains a true form, as grinding the tooth face does not affect it.

The construction is simple. It is held in a chuck and



TOOL FOR ROUNDING CORNERS

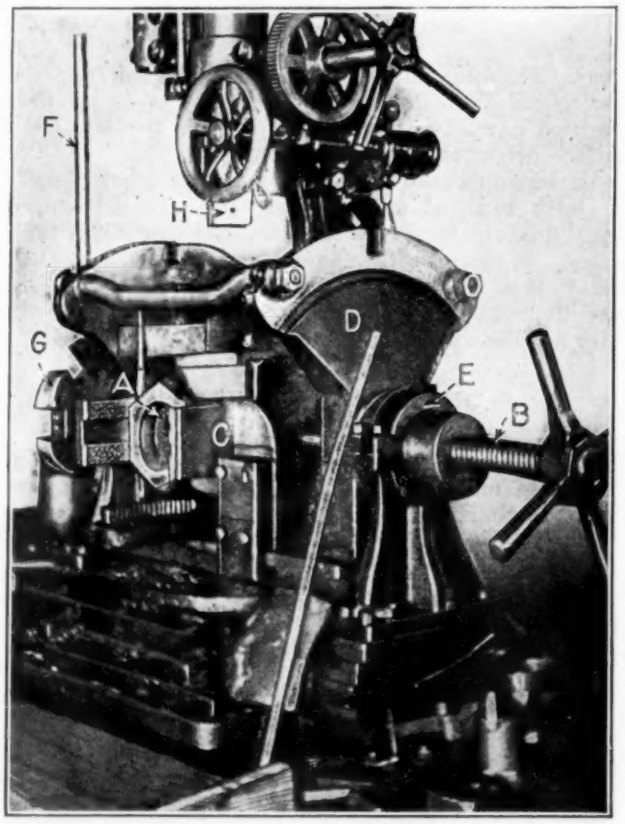
piloted by a bushing in the fixture that holds the connecting-rod. An adjustable stop is provided in the fixture, which operates on the ground end of the pilot. The body of the tool is of machine steel, pack-hardened and ground. Three grooves are provided in the pilot for chips and cutting fluid. The cutter is of high-speed steel with nine teeth, the form being cut with a tool with relieving attachment. The cutter is driven by a pin and is held in place by a check nut.

A Drilling and Tapping Jig for Large Pipe Fittings

By H. J. Ventner

Some of the large pipe fittings made by the Jarecki Manufacturing Co., Erie, Penn., are drilled and tapped in the indexing jig as shown. The jig is mounted on the table of a large vertical drilling machine.

In the illustration the large tee *A* is shown in place in the jig for the purpose of machining and is ready



INDEXING FIXTURE FOR DRILLING AND TAPPING LARGE PIPE FITTINGS

to be tapped. It is clamped in the jig by means of the screw and handwheel *B* and special jaws *C*.

After drilling and tapping one side the body of the jig *D* is turned about the trunnions *E* and is indexed at 90 deg. The handle *F* locks into the notched plate *G* at the left of the jig and insures that the openings in the fitting will be in alignment and at the correct angle. No special fixtures are used for holding the large taps, other than the hollow sleeve *H*, to fit a square shank tap. On these large fittings the spindle revolves quite slowly, and when the tap has reached the required depth the operator reverses the machine. In this way he is able to gage the depth of the threaded portion within a small fraction of a turn.

Government Tax on Western Machine Shops

BEGINNING with July 1, every subscriber to the *American Machinist* who lives west of the Mississippi must pay $1 per year to Uncle Sam for the privilege.

On July 1, 1918, Congress put a seventeen million dollar tax on intelligence and sectionalized this country by instituting the zone system on second-class postage, under which our newspapers and periodicals are carried. Ninety per cent. of the information and instruction of those who read comes to them through newspapers and periodicals under this classification.

Our War Congress decided that there should be no distinction between information and merchandise and it divided the reading public of America into eight different classes depending on geographical location. It decided that the people who live in the Atlantic Coast zones, where most of the national publishing houses are located, shall get their customary reading matter quite easily, but that the people who live further west shall be progressively penalized according to distance up to the point where it becomes prohibitive in cost to read anything except the county paper. One concession was made by these law-makers; they agreed to apply this increase over a period of three years so that the maximum comes in 1921.

Much as this statement sounds like an exaggeration it is absolutely borne out by the facts. In 1917, it cost $1.19 for postage to mail a single year's subscription of the *American Machinist* to any part of our country. This was at a flat rate of one cent per pound. The following table shows what it costs in 1919, for postage to the various zones and what it will cost in 1920 and in 1921, for postage on a single year's subscription to the *American Machinist*.

POSTAGE COST

What the Government does tax and will tax our readers for postage on a year's subscription. The following table shows the postage under the old law (1917) and that under the zone law.

Zone	1917	1918	1919	1920	1921
1—2	$1.19	$1.40	$1.68	$1.93	$2.17
3	1.19	1.65	2.17	2.67	3.15
4	1.19	2.14	3.15	4.13	5.11
5	1.19	2.38	3.64	4.87	6.09
6	1.19	2.62	4.13	6.60	7.07
7	1.19	3.12	5.11	7.07	9.03
8	1.19	3.36	5.60	7.81	10.01

Note that on July 1 the postage alone on a subscription mailed to the seventh and eighth zones (which includes the territory west of the Rocky Mountains) will be over $5—*more than the subscription price of the paper.* Also note that in 1921, the postage on a subscription to California will cost over $10. This zone system on reading matter actually erects a Chinese wall in the form of prohibitive postage around each zone with the effect of keeping out information from another zone.

We looked upon this unheard of taxation on intellect as a *war* measure, particularly as it was a part of the War Revenue Bill. We did not believe nor did other publishers or readers of publications believe that this discrimination in favor of illiteracy would be seriously considered after the war emergency had passed. And rather than impose upon our readers the increased burden of what we thought was to be a temporary tax, we paid this ourselves and looked forward hopefully to the repeal of this legislation.

Now we find, to our astonishment, that it is proposed to perpetuate this monumental piece of class legislation.

For the reader's sake we were willing to bear the whole of this burden of taxation during the war. But it is obvious to anyone who studies the above table that no publisher can continue this as a permanent expenditure and so, beginning July 1, subscribers to the *American Machinist* who live west of the Mississippi River must add $1 for extra postage on their year's subscription.

In making this $1 increase we are by no means putting the total burden even of the present year's postal increase upon our western readers. Theoretically we should have a graduated subscription price to meet this iniquitous postal arrangement. This is a practical impossibility at present, and so, until we are able to develop a method of bookkeeping which will apply this burden equitably, we must use the Mississippi River as a natural dividing line and apply the increase equally over the western zones.

We are indeed ashamed that in this enlightened age of free schools and education it is possible to find men able and willing to sectionalize this country, to discriminate against the man who must get his education through reading and to make the mechanic and the engineer pay, in the form of postage on his technical paper, for the free distribution of the farmer's seeds.

The inevitable result, unless this unwise and unjust legislation is repealed, will be to put the distribution of all periodicals on the basis that existed fifty years ago when readers paid a flat subscription price "plus the postage."

It is beyond belief that when the representatives of our western states learn the sentiments of the reading public they will tolerate the continuance of this injurious discrimination against their constituents.

Frederick Holz

Frederick Holz of Cincinnati, formerly president of the Cincinnati Milling Machine Co., died at his home in Cincinnati on Monday, May 12, 1919, in his sixty-seventh year.

Mr. Holz was born at Erbach-bei-Ulm, Germany, on Apr. 23, 1853, and attended school at that place. He

FREDERICK HOLZ

left school to become an apprentice machinist at Vienna and came to this country at the age of 19, finding employment with a model maker named Loutenschlager in Cincinnati.

In 1880, he and George Mueller of Cincinnati entered into partnership and operated a small shop on upper Vine St. where they did model, repair and experimental work. They also built paper-bag machinery and later undertook the manufacture of screws and taps.

As the partners were too poor to buy a milling machine for fluting their taps Mr. Holz made one with a wooden base. In 1884 they were incorporated as the Cincinnati Screw and Tap Co. with Mr. Holz as president, and continued under this name until 1889 when the screw and tap part of the business was sold and the company was re-incorporated as the Cincinnati Milling Machine Co. Mr. Holz was president of this new company until he disposed of his interests in 1905.

Mr. Holz is survived by his widow, a daughter and four sons. He was a 32nd-deg. mason, a member of Syrian Temple, A. A. O. N. M. S., North Cincinnati Gymnasium, Federated Improvement Association, Cincinnati Metal Trades Association, and of the board of the Old Men's Home of Cincinnati.

He was among the first to appreciate the value of proper shop equipment and introduced high-grade work benches and iron bench blocks in the early days. He is credited with being the first man in Cincinnati to dip finished parts in gasoline before assembling. He was an early advocate of grinding all parts and fully appreciated the need for good gages.

Mr. Holz was the first to use a milling cutter for threading taps, to install the positive feed drive, angular shaft for elevating the knee and centralized control of levers in milling machines and was the pioneer designer of the modern universal center and tool grinder. He also made many improvements in universal indexing heads for milling machines.

He possessed a very positive character which was one of the secrets of his success. He combined with it a strict honesty which was observed toward his employees as well as his business associates.

Hand Versus Power Feed in Grinding

BY C. ONTARIO

The articles on surface grinding on page 901, Vol. 49, by Donald Baker, page 10, Vol. 50, by Harry Senior, and page 356 of the same volume by A. W. Suiter are sure proof that all toolmakers do not think alike.

I do not think the feed should be used all the time and on all work; neither do I think all grinding should be done by hand. Judgment should be used, and if the toolmaker is not up to the mark the foreman should instruct him.

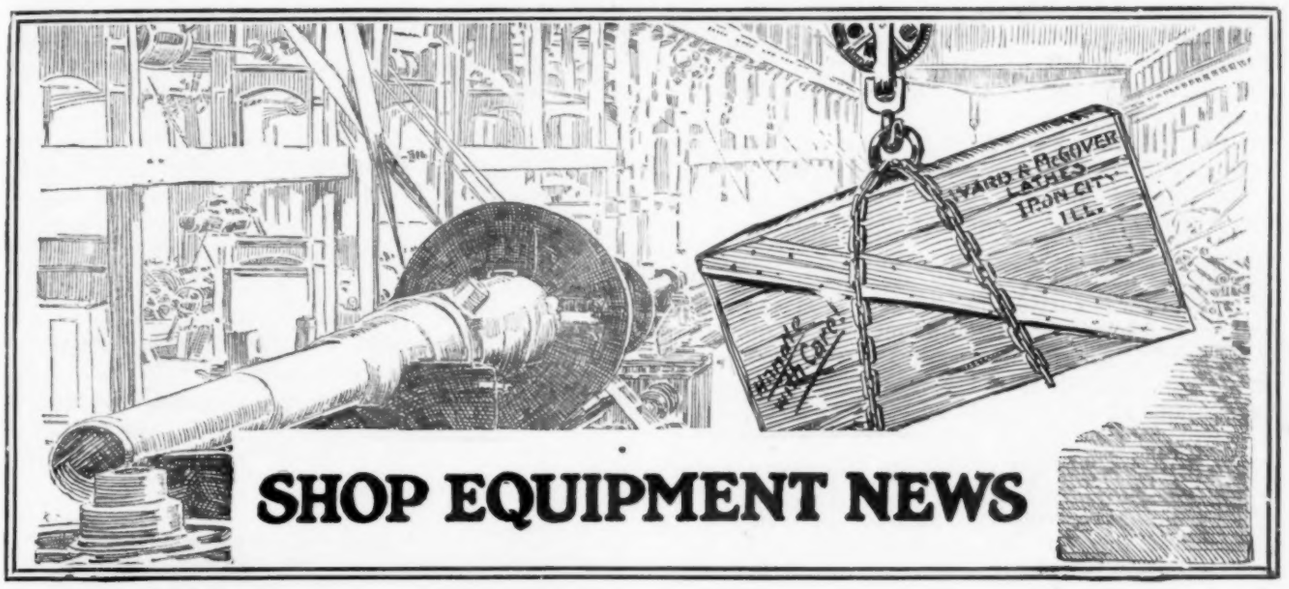
Recently we had a die of 8 x 14-in. surface which, because of an accident to its cutting edge, required to have about ⅛ in. ground off. This was some job to do by hand, also rather a long job for a high-priced man to sit on a stool while it was being done, and as we have but one machine we could not tie it up long enough to do the work at one setting, consequently the work was done in several stages to allow other work to be done which was urgently needed. While the machine was running the man who was looking after it (in this case it was the foreman) was also busy with other work.

Most of our work is done with the power feed while the man who is looking after it is busy with other work, and we think we get our grinding done about as cheaply as possible. We certainly would not want the power feed dismantled as we think we have sufficient intelligence to know whether to use it or not.

Mr. Suiter says if your grinding machine is connected with an exhaust fan and you are supplied with proper wheels the only thing that will make it a disagreeable machine to run is a failure to keep it clean. Well, I have seen such machines connected to a fan that practically had no suction; the pipe had so many openings in it between the machine and the fan that the latter was practically useless, but the manager had complied with the law and he was not interested enough in the employees to know that he would get better results if conditions were better.

There are many such employers in business and as long as you are in such a shop you have to do the best you can under the conditions as you find them. I think I hear some one say they would not work in such a shop; let me say that very often for reasons over which you have practically no control you have to put up with undesirable conditions for a longer period than you care to.

In conclusion let me say that it is up to the intelligence of those who have charge of the work whether or not the power feed is used. Some work is done by hand in some shops that would be done with the power feed in others; there is no universal way. The nature of the work, the class of machines, the conditions under which the work is done, and the kind of men available are all factors in reaching a decision.

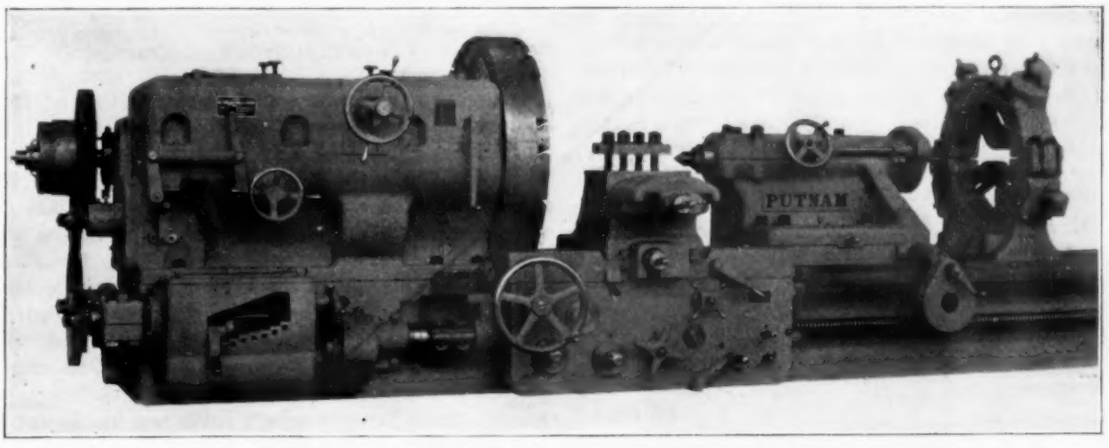


SHOP EQUIPMENT NEWS

Putnam 54-Inch Geared-Head Engine Lathe for Heavy-Duty Work

A 54-in. geared-head engine lathe that has been built for heavy-duty service is shown in the illustration. This machine is a product of the Putnam Machine Works of Manning, Maxwell & Moore, Inc., Fitchburg, Mass., and it is stated that the design of the parts is such that they will transmit 40 hp. without vibration or without causing any strain. While the regular swing of the machine is slightly over 54 in., the construction is such that the head, etc., can be easily raised on blocks where a greater swing is needed for an emergency job, a swinging link being provided at the left end so that the gearing can be kept in mesh.

The headstock is of the inclosed all-geared type giving 18 spindle speeds with a constant-speed initial drive shaft. The bearings are bronze bushed and are carried in the lower half of the headstock so that the cap can be removed for inspection purposes without disturbing any of the bearings or other parts. The machine can be furnished for either belt or motor drive, a friction clutch combined with a brake allowing the machine to be stopped or started without stopping the motor, or in the case of a belt drive this feature allows the machine to be belted directly from the lineshaft. When a motor is used it is mounted on top of the headstock at the rear, the section of the cap carrying the motor being a separate part, so that the motor does not have to be removed in case it is necessary to lift the cap for any reason. The cap is provided with two large openings that serve for any ordinary inspection purposes, these openings being closed with swinging covers to prevent the entrance of any foreign material.



PUTNAM 54-INCH GEARED-HEAD ENGINE LATHE

Width of bed on top, 53 in.; depth of bed, 24¼ in.; actual swing over ways, 56¾ in.; actual swing over compound rest, 38¾ in.; actual swing over taper attachment, 35 in.; distance between centers with 22-ft. bed, tail flush, 9 ft. 11 in.; distance between centers with 22-ft. bed with overhang, 10 ft. 8 in.; front spindle bearing, 8½ in. in diameter, 16 in. long; rear spindle bearing, 7 in. in diameter, 13 in. long; spindle nose, faceplate keyed on; centers, Morse taper No. 7; spindle speeds, 18, with two sets of back gears, 2.715 to 154.05 r.p.m.; number of gears in headstock, 16; diameter of driving pulley, 36 in.; width of driving belt, 6 in.; motor recommended, 40-hp. constant-speed; length of power feed of compound rest, on angular travel at one setting, 15 in.; number of changes through quick-change gear box for screw cutting and feed, 40; range for screw cutting, ⅛ to 14 threads per in.; longitudinal feeds, 0.016 to 0.444 in. per spindle revolution; range of crossfeeds, 0.019 to 0.543 in. per spindle revolution; travel of tailstock spindle, 26 in.; maximum travel at one setting of taper attachment, 42 in.; range of taper attachment, up to 10 deg. or 4 in. taper per ft.; minimum capacity of center rest, 5 in.; maximum capacity of center rest, 27 in.; weight with 22-ft. bed, 68,300 lb.; additional weight for each foot additional of bed, 1000 lb.; floor space without taper attachment, 25 ft. 9 in. by 9 ft. 10 in.; floor space with taper attachment, 25 ft. 9 in. by 12 ft. 6 in.

The 18 spindle speeds are controlled by the two handwheels and the lever at the right end of the head, while the lever at the left operates the friction clutch and brake. An arrangement is provided so that it is impossible to shift gears while the friction clutch is engaged. Releasing the friction clutch also engages a Raybestos lined brake for stopping the spindle.

The transmission gears with the exception of the very largest are of chrome-nickel steel heat-treated, and in fact all other gears in the machine except a few used in the apron for friction are heat-treated. The spindle thrust is carried on alternate steel and bronze washers and lubrication is by an oil bath. Lubrication of the head is a particular feature of the machine. A gear pump, located at the rear of the head, pumps a continuous stream of oil to all bearings and a telltale is provided so that it is possible for the operator to see at all times whether or not the lubrication system is in operation.

The gears have been kept as near uniform size as possible and the bearings are close together in order to insure rigidity. The speed changes are by means of selective-type sliding gears. The headstock is secured to the bed by means of six bolts. The gear box located at the left provides a wide range of speeds for thread cutting.

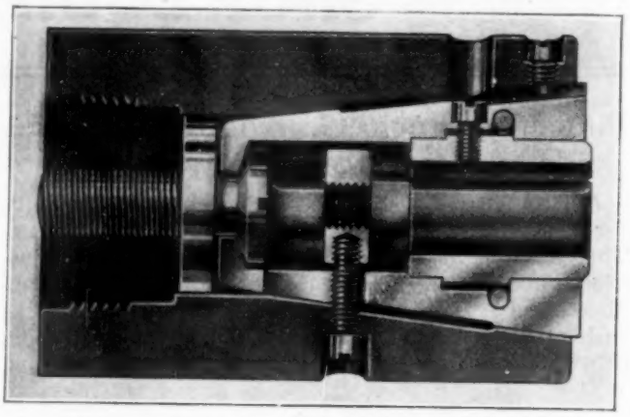
The apron is of the double-wall or box type, all gear shafts being supported on both ends. The front of the apron is removable and all studs and gears, except those located at the rear of the apron connecting to the lead screw, can be removed without removing the carriage from the bed. A throw-out is provided for the carriage handwheel. The feed rack is made of 50-point carbon steel and has teeth of stub form, 3-pitch.

The longitudinal and crossfeeds are operated by friction and are reversed in the apron. The safety device prevents an engagement of the nut for screw cutting while the feeds are engaged. The carriage has three bearings on the bed, two on raised ways in the front and back and one on the flat inside front way, this giving support directly beneath the cutting tool. Oil pipes for lubricating the carriage bearings are brought out under a small cover located on the front of the carriage. The compound rest has a square base giving a large clamping surface, and is provided with power cross, and angular feeds. These may be used independently or combined as desired. The top of the rest is provided with two large key slots and the tool-holding bolts are fitted with T-shaped spacing bars which keep them the proper distance apart at all times.

The tailstock is of the set-over type and is clamped to the bed by six bolts. It is provided with a brace that engages a rack in the bed, this feature preventing any slipping due to heavy cuts. The sections of rack are located in the center of the bed but can be taken out to facilitate the removal of chips. The tailstock center may be moved by a crank on the square at the rear end, or may be moved by the handwheel at the center of the tailstock, this wheel being brought forward to this point for the convenience of the operator. A particular feature is that all the squared shafts on the machine are the same size and all the clamping bolts are of the same size, this feature making only two wrenches necessary for the operation of all of these parts. The centers are of Morse No. 7 taper and are withdrawn by means of hexagonal nuts screwed on the front end. The tailstock is moved along the bed by the side bracket and compound gearing. The steadyrest is of the five-jaw type, the jaws being provided with removable bronze tips. The regular length of bed is 22 ft. but other lengths can be furnished if desired.

"Logan" Air-Operated Compensating Collet Chuck

The "Logan" air-operated compensating collet chuck shown in cross-section in the illustration is being manufactured by the Logansport Machine Co., Logansport, Ind., and sold by the Frank G. Payson Co., 9 South Clinton St., Chicago, Ill. The chuck housing or body is of hardened steel, ground, the taper seat for the collet jaw being a part of the housing, giving the advantage of one-piece construction to the body and reducing the number of parts. The jaws are not hinged or fastened together in any manner, but are simply set



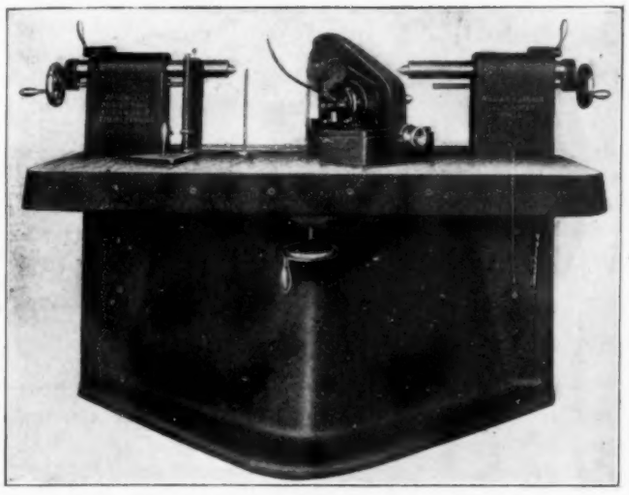
CROSS-SECTION OF "LOGAN" AIR-OPERATED COMPENSATING COLLET CHUCK

loosely into the body and held in position at the draw-rod end by the taper on the draw-rod connecting screw and held expanded at the front end by means of a spring. This floating type of jaw construction allows the jaws to adapt themselves for work of different diameters and allows an equal and positive grip the entire length of the work. The jaws have a maximum travel of $\frac{5}{8}$ in. when operated at full stroke, but this can be reduced if desired. The long, slow taper gives a powerful grip and allows a smaller air cylinder to be used, with consequent saving in air consumption. The chucks are regularly supplied in the two- and three-jaw type, with master collet jaws to which false jaw blocks for holding various sizes can be fitted, and in 1½-, 2½-, 4- and 6-in. sizes.

Barnes Precision Cutter Grinding Machine

William O. Barnes, Leominster, Mass., has recently placed on the market the No. 2040 precision cutter grinding machine shown which is for grinding gang milling cutters. It is stated that this machine provides a means for the grinding of any milling cutter within its range, whether a single cutter of simple shape or a large complicated gang with either straight or curved contours, and that the operation becomes one of precision and free from errors customarily due to the lack of skill on the part of the operator.

Gangs can be ground on their own arbors at a single



BARNES NO. 2040 PRECISION CUTTER GRINDING MACHINE

Capacity, cutters up to 20 in. in diameter and 40 in. between columns; floor space, 100 x 31 in. over-all; weight, 2250 lb.

setting and clearance can be given to side and peripheral teeth. The cutter or gang while still on its arbor is placed on centers carried by the two columns of the machine, and a flat templet having the desired contour is laid on the ledge that may be seen at the back of the table. This templet is then slid along the ledge until the cylindrical try square shows it to be in correct longitudinal position with regard to the cutter, after which it is clamped in position by turning the socket screws shown in the front of the table. The hand-wheel beneath the table is then turned until the try square shows the templet to be in correct transverse relation with the cutter.

The grinding wheel is motor driven and is mounted on a carrier that is equipped with a former pin and a tooth rest, and is adapted to slide freely over the surface of the table. Means are provided for so truing the wheel that its periphery at the top of the rest is in exact vertical alignment with the surface of the former pin, so that to grind the cutter the different teeth are simply placed in contact with the top of the rest and the carrier slid along the table, keeping the former pin in contact with the templet, while the grinding wheel shapes the cutter tooth to the same line. The top of the rest for the cutter teeth is made conical in order to permit the grinding of both straight and spiral teeth.

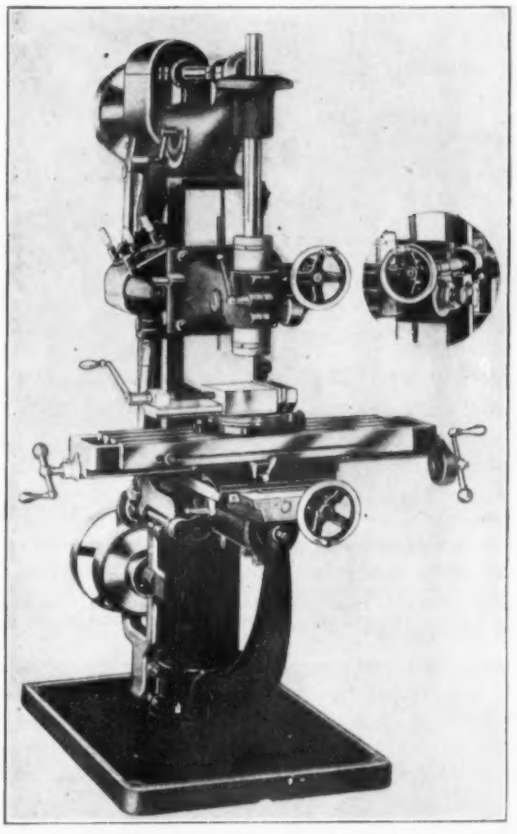
Knight No. 3 Milling and Drilling Machine

A larger machine as an addition to their general line has been brought out by the W. B. Knight Machinery Co., St. Louis, Mo., which has been designated as the No. 3 Knight milling and drilling machine, and is similar in design to the other machines of this line, but embraces several new features.

This new machine which is shown in the illustration is considerably heavier than those previously built, and is intended to handle a heavier class of work, being designed with the intention of having it rigid enough to obtain accurate results on any work within its range. The working surface of the table has been increased and all other dimensions increased proportionately.

The spindle, forged from 60-point carbon steel, has been accurately ground to size and is made large and of ample proportions to give rigidity and strength. It runs in a solid bronze bushing 11 in. long, and this bushing is tapered and may be adjusted longitudinally to take up wear by simply loosening one nut and tightening another. The thrust washers are made of bronze and hardened steel, all grooved and ground, and all these points are planned to insure accuracy and preservation of the alignment of the spindle. The distance from the center of the spindle to the column is 10 in., and the spindle head is adjustable, which in connection with the vertical feed of the table gives a maximum distance from the spindle to the table of 18 in.

A vertical feed of 6 in. on the spindle is one of the new features with which the No. 3 machine has been provided, and is an addition to the longitudinal and crossfeeds provided on the previous machines. This new feed feature will be of particular advantage in boring work and in drilling to a certain depth, and the various feeds of this vertical movement bear the same ratio as those of the table. This vertical feed is also provided with an automatic throw-out which may be regulated in either direction by means of a graduated set collar. In addition to this there is a positive



THE NO. 3 KNIGHT MILLING AND DRILLING MACHINE

Floor space, 72 x 62 in.; height, 85 in.; weight, 2700 lb.; diameter of countershaft pulley, 14 in.; belt face, 3 in.; speed of countershaft pulley, 300 r.p.m.

throw-out which prevents the spindle from traveling beyond its limit in either direction.

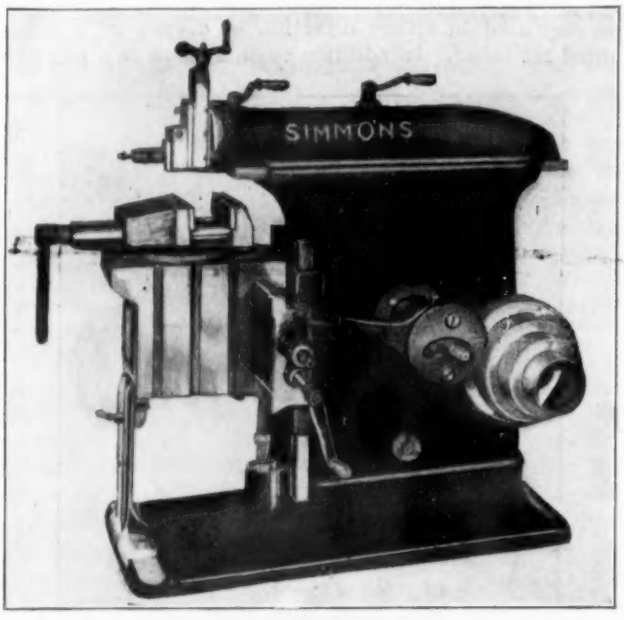
The table is designed with a view to obtaining great rigidity and resistance to distortion, and at the same time to be of convenience to the operator in handling the work. The working surface is 8½ x 33 in. and has three T-slots ⅝ in. wide, which are made of generous depth to insure against breaking out of the metal

around the clamping bolt. The table tilts and may be set to any angle within a range of 70 deg. by means of a graduated dial provided on the projecting arm which carries the knee. The table may also be pivoted about the column. It is claimed that these two features have proved themselves to be great time and labor savers. The longitudinal feed of the table is 24 in. and the crossfeed is 10½ inches.

The spindle is provided with eight speed changes ranging from 25 to 300 r.p.m., and eight feed changes ranging from 0.008 to 0.060 in. per revolution of spindle. There are also eight changes on both of the table feeds which have the same range. All gears have a large face and are cut with a heavy pitch.

Simmons Crank Shaping Machine

The Simmons Machine Co., Inc., Albany, N. Y., is now marketing the 17-in. single-geared, crank shaping machine shown in the illustration, this being designed to meet the demand for a medium-duty machine for general manufacturing work. Work may be attached to either the top or the side of the table, which is provided with T-slots and also an automatic horizontal feed of 13 in. The elevating screw is of the double-screw type operated by a crank mechanism. An outside knee support is provided.



SIMMONS 17-INCH SINGLE-GEARED CRANK SHAPER

Stroke, 17 in.; table, 10 x 13 in.; head graduated; keyseating capacity, up 3 in. in diameter; swivel vise graduated; elevating screw, double, knee support being also provided; cone pulleys, four step for 2½-in. belt; automatic horizontal feed, 13 in.; weight, 1700 lb.

Shehan Automatic Die Heads

The Shehan Tool Co., 321 Frankfort Ave., Cleveland, Ohio, has recently placed on the market a line of automatic self-opening adjustable die heads, one of which is shown in the illustration. Fig. 1 shows the assembled head, while Fig. 2 shows the device disassembled to illustrate the various parts. The particular feature of this line of die heads is the use of double-ended chasers having cutting edges on both ends. These chasers can be supplied with duplicate threads on both ends or with different diameters and pitches on the two ends as desired. This feature is said to greatly lower the operating cost of the heads. All parts except the shank are hardened and ground and the parts are interchangeable. The heads are made on the round construction principle throughout making possible the elimination of cams and other such parts. It is stated that the heads have a comparative few number of parts, that they are very easy to adjust, that they are very quickly assembled and that the outside diameters are less than those of any other type head on the market. The four operating shafts that oscillate the chasers have teeth that engage the chasers their full cutting length, giving a perfectly distributed bearing that is said to add much to the accuracy and life of the cutting points, and make it impossible for the chasers to tip, or cut tapers. The adjusting ring is mounted on the shank proper, two adjusting screws fitting into recesses, the ends of these screws resting upon the two driving pins. The adjustment is accomplished by means of a screwdriver. The operating ring is mounted on the chaser head, and has four hardened pins engaging the adjusting ring, the reverse side being recessed to contain the compression springs that control the chaser movement. In locking position the adjusting ring is engaged at four points. The head can be cleaned by simply removing the faceplate with a screwdriver.

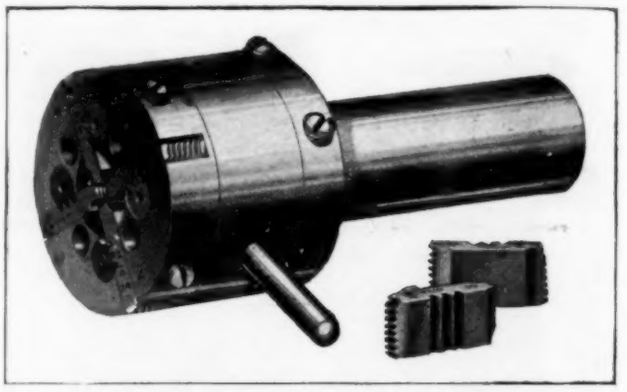


FIG. 1. SHEHAN AUTOMATIC SELF-OPENING ADJUSTABLE DIE HEAD

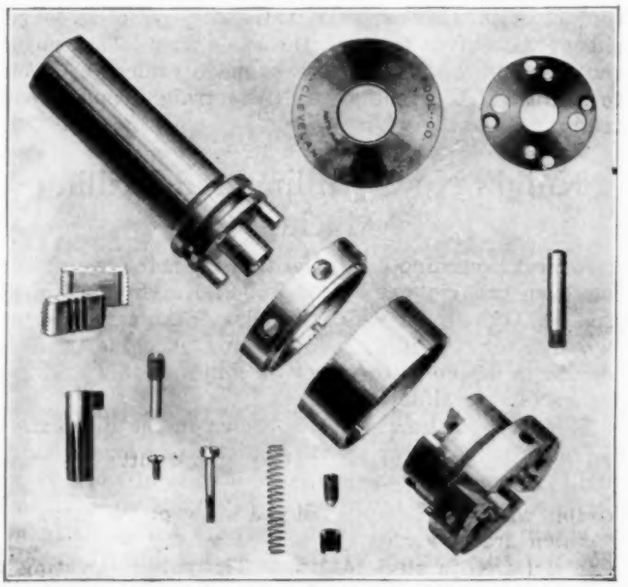
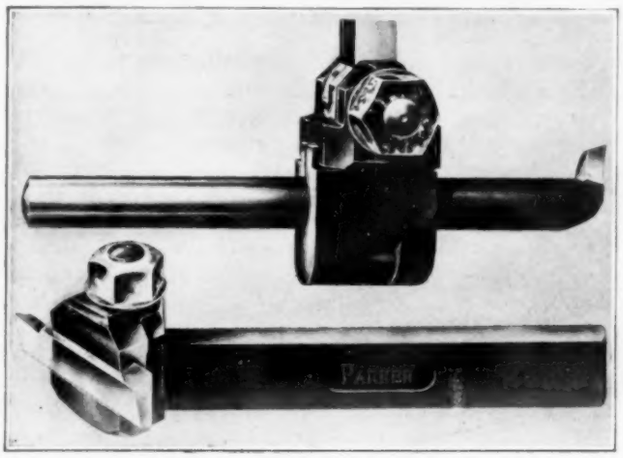


FIG. 2. A DIE HEAD DISASSEMBLED

Parker Universal Toolholder

The illustration shows a universal toolholder that is being manufactured by the Parker Machine Co., Boston, Mass. The holder is universal and reversible with a positive locking device for each one of the five positions obtainable, it being possible to use any type of bar-stock cutters, either flat, square, or round, and also special shaped cutters. It is claimed that more work can be produced with this holder than with a complete set of

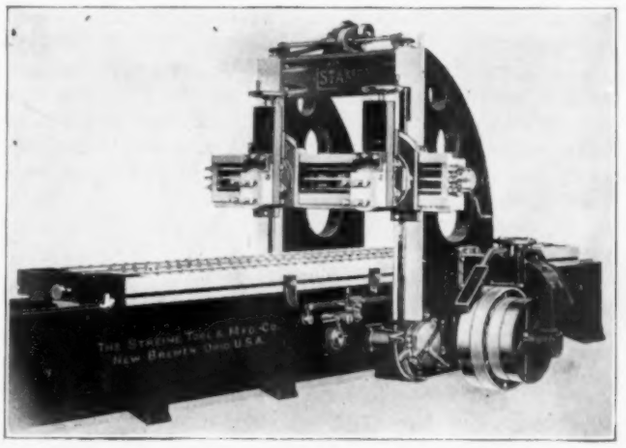


PARKER UNIVERSAL TOOLHOLDER

single-purpose holders and that the breakage of high-speed-steel tool bits and setscrews is eliminated. The illustration shows the toolholder with a rough-turning cutter in place and also with an internal boring tool ready for work. The holder is supplied with 15 cutters and forms a complete outfit in itself.

"Stamco" Heavy-Duty Planing Machines

The Streine Tool and Manufacturing Co., New Bremen, Ohio, has just placed on the market a new line of extra-heavy-duty planing machines that are built in five sizes, 36 x 36 in., 42 x 36 in., 42 x 42 in., 48 x 42 in. and 48 x 48 in. The bed is of box-type construction with a diaphragm extending across the entire top except where the opening for the gears is necessary. The table slides on V-ways, and is said to be unusually wide and well ribbed, being provided with ledges to protect the V-tracks from dust and chips. The rack for driving is set into the table and fastened in place with capscrews and steel taper pins, the rack teeth being 2½ in. diametral pitch. Box-type construction is used for the housings which are bolted and pinned to the bed, and are planed and finished for the application of the side heads. The crossrail is heavy, with a large bearing surface, the rail screws and rail rod as well as the rail elevating screws being fitted with ball-thrust bearings, micrometer collars being provided for the rail screws. The heads are fitted with taper gibs, and the slide screws have micrometer collars and ball-thrust bearings. The side heads are counterbalanced, are fitted with automatic feeds and can be run down below the level of the table when not in use. All gears except the main drive pinion are of semi-steel, this particular one being machined from a steel forging. The power elevating device is located on the top brace, and is operated through a clutch so made that it will immediately disengage on



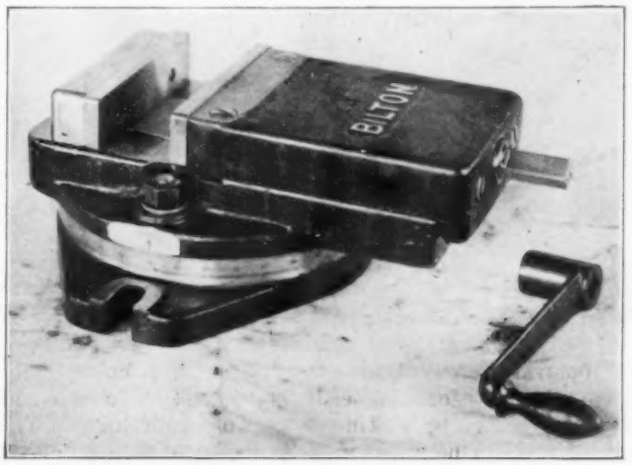
"STAMCO" EXTRA-HEAVY-DUTY PLANING MACHINE

Made in 5 sizes: 36 x 36 in., 42 x 36 in., 42 x 42 in., 48 x 42 in., 48 x 48 in. Specifications for 42 x 42-in. machine: Width of work planed, 43 in.; height of work planed, 43 in.; width of platen, 39 in.; thickness of platen, 7 in.; distance between V's, 24 in.; depth of bed, 25 in.; face of housing, 9 in.; face of crossrail, 16 in.; length of saddle bearing on rail, 17½ in.; length of rail-head down feed, 15 in.; face of bull wheel, 7½ in.; diametral pitch of bull wheel, 2½ in.; width of cutting belt, 3½ in.; diameter of cutting pulley, 30 in.; diameter of return pulley, 24 in.; width of countershaft belt, 6 in.; diameter of countershaft pulley, 18 in.; height, 105 in.; width, 92 in.; countershaft speed, 350 r.p.m.; horsepower required for 50-ft. cutting speed of platen, 25.

encountering any obstruction. The bull gear shaft is stationary and is supported in the bed. All running shafts are fitted in special bushings while the pulley shaft is mounted in heavy-duty Hyatt roller bearings. The driving pulleys are of aluminum cast on a semi-steel chill to reduce momentum to a minimum. The shifting mechanism can be operated from either side of the bed, and the table is provided with dogs on both sides. A safety locking pin is provided for each belt shifter. The countershaft is also mounted in Hyatt roller bearings, a heavy flywheel pulley being provided.

Bilton Swivel Machine Vise

The Bilton Machine Tool Co., Bridgeport, Conn., has recently placed on the market the swivel-base machine vise shown in the illustration. This vise has been designed for heavy work, the sliding jaw being pulled up against the work. This jaw is gibbed to the base in order to prevent it from rising when pressure is applied, the design also tending to hold the jaw on the base. The stationary jaw is of box-form construction, is keyed to the base and wholly incloses the operating screw, the



BILTON MILLING VISE

end of which bears just back of the face of the jaw. The removable face of the stationary jaw is held in place by two screws, the heads of which are made long and project through to the back in order that the face may be conveniently removed. It will be noticed that the screw and operating mechanism of the vise are wholly inclosed in the box-type stationary jaw, so that dirt and chips are absolutely excluded.

Simplex Sine Bar

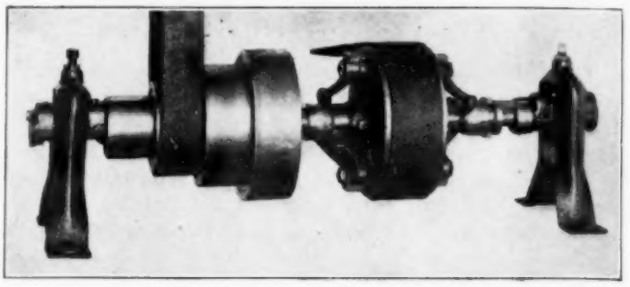
The sine bar illustrated is the product of the Simplex Tool Co., Woonsocket, R. I. This is a 5-in. bar, is mounted on a base and can be set either by measuring over the bottom of the base and the button with a micrometer, or between the top of the base and the button with blocks. With the swinging construction used it is only necessary to set one end of the bar.

SIMPLEX SINE BAR

The device may be used against an angle plate or laid flat upon its side as desired, as the side of the base and side of the bar are in one plane. The bar itself is of channel construction and in some cases small work can be clamped directly to it. The clamping device for the bar is said to be entirely new, and capable of locking the bar to the base with a very powerful and centralized grip, at the same time eliminating the tendency to spring or move the bar. A special steel is used in the construction of the device which is hardened and ground all over. Gage blocks for setting common angles without figuring can be furnished if desired, the outfit when so ordered being packed in a hardwood box.

"Abitz" Reversible Countershaft

The "Abitz" reversible countershaft is a recent product of the Rockford Metal Specialty Co., 720 South Main St., Rockford, Ill. The countershaft is arranged to give forward, neutral and reverse speeds, and makes use of a planetary-gear mechanism to accomplish these results. A clutch at the right fixed to the shaft engages the pulley, while a stationary clutch at the left loosely mounted on the shaft engages the idling drum, and acts as a brake. Two spools fixed to one shifter arm are provided to expand the clutches. If the shifter arm is thrown to the left, the right clutch is expanded, engaging the pulley and driving the shaft in the same direction, the whole mechanism revolving as one unit; while if the shifter is thrown to the right, expanding the left clutch the idling drum will remain stationary, forcing the pinion to drive the gear fixed to the shaft in the opposite direction or reverse. This construction gives forward, neutral and reverse, the belt running



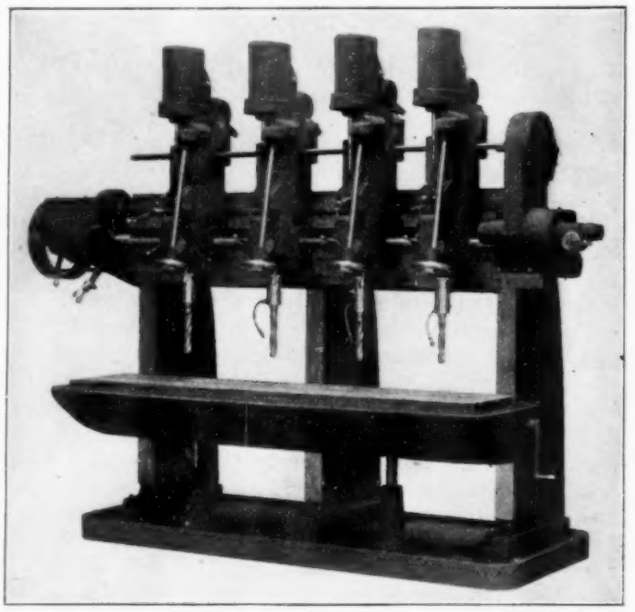
"ABITZ" REVERSIBLE COUNTERSHAFT

in one direction, through the control of one lever. The gears are working only when the countershaft is in reverse; when the shaft is at rest these gears merely idling around in their planetary path.

Defiance No. 23 Independent-Feed Rail Drilling Machine

The No. 23 independent-feed rail drilling machine, with No. 33 independent heads, is a recent product of the Defiance Machine Works, Defiance, Ohio. This is a heavy-service production tool, and especially intended for use in locomotive, railway, gas-engine, automobile, or other shops where the work includes heavy gang or heavy jigged drilling.

The speed mechanism is attached to the upper end of the upright at the left end of the frame, and consists of two cones of hardened-steel gears, back gears, and a hardened roll-in gear. The cones consist of three gears each, thus providing three different gear ratios which, when used in conjunction with the back gears, give six speed changes. The shafts in the speed box



DEFIANCE NO. 23 INDEPENDENT-FEED RAIL DRILLING MACHINE

Capacity in solid steel, 2 in.; maximum distance, nose of spindle to top of table, 32 in.; distance from center of spindles to face of column, 12¼ in.; minimum distance center to center of spindles, 8 in.; maximum distance center to center of outside spindles, 78 in.; length of power feed, 12 in.; working surface of table, 20 x 98 in.; vertical adjustment of table, 12 in.; speed changes, six, 25 to 186 r.p.m.; feed changes, three, 0.006, 0.009 and 0.014 in. per spindle revolution; diameter of spindle nose, 3 in.; diameter at driving point, 3 in.; diameter of spindle sleeve, 4 in.; Morse taper in spindle, No. 5; drive pulley, 20 x 5¼ in.; speed of drive pulley, 350 r.p.m.; horsepower required, 10; floor space, 56 x 144 in.; net weight, 12,180 lb.

rotate in Hyatt roller bearings, and the drive shaft which transmits the power from the speed mechanism to the spindle turns in combined radial and thrust ball bearings. The speed box receives its power from a constant-speed pulley, a Johnson friction clutch being used.

The feed mechanism is inclosed and carried at the upper end of the upright at the right end of the frame, the feed changes being obtained through two cones of gears driven by the spindle drive shaft. These gear cones give three changes of feed for each spindle speed, the feed changes being effected by a slip key operated by a hand lever. The feed is transmitted from the two gear cones to the feed shaft by the gears and a worm and worm gear, the end thrusts being carried by ball bearings. A handwheel is provided for advancing or returning each spindle rapidly.

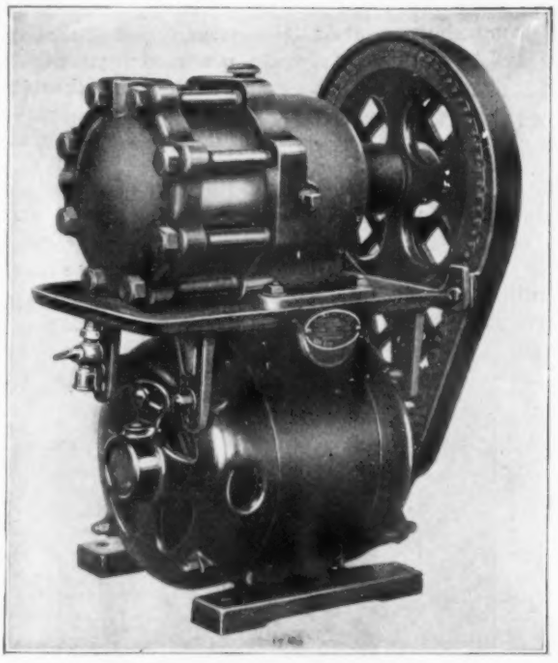
The dove-tail method is used to gib the spindle head to the crossrail, each head being a self-contained unit that may be adjusted longitudinally along the rail by means of a crank handle operating through a rack-and-pinion mechanism. The spindles themselves are of forged high-carbon steel driven by spiral gears with two keys extending from the gear through the sleeve and into ways in the spindle. The end thrust on these keys and the spiral gear is taken by a ball bearing, while the spindle thrust is taken on SKF ball bearings. This drive is located in the lower end of the head, a feature that reduces torque in the spindle to a minimum. Each spindle is counterbalanced, and is independent of the rest. The levers used to apply the feed and drive to each spindle are interlocking, so that power feed cannot be engaged while the spindle is not being driven. Adjustable stops are provided for drilling to a given depth.

The table is a box type casting and is adjusted vertically by means of a crank-operated mechanism connecting to the two jackscrews through a worm and worm gear. The jackscrews are located in the center line of the spindles. A cored section of the table serves as a reservoir, and the table casting is shaped on all four sides so as to form a trough into which the cutting compound flows before passing to the reservoir. The pump for circulating the cutting compound is fastened to the upright at the left end of the frame and driven from the countershaft.

Lubrication is by a force-feed, gravity-flow and splash system combined, made possible by the all-inclosed unit construction. The speed mechanism, feed mechanism and each of the spindle heads are provided with independent and self-contained oiling systems, the contents of each unit being partly submerged in a bath of oil, while the bearings are lubricated by force feed through individual leads which carry a sufficient flow of oil to flush all inclosed parts on its return to the reservoir.

Utility Pressure and Vacuum Pump

The Utility Compressor Co., Detroit, Mich., has recently placed on the market a number of models of the pressure and vacuum pump shown in the illustration, Fig. 1. Fig. 2 shows a cross-section view of a different model but indicates the general construction. The rotary motion of the pump shaft is converted into a reciprocatory motion of the eight pistons by a connecting-rod rocker pivoted on a universal joint. The connecting-rod rocker is engaged in the crankshaft at a proper distance to give a stroke of $1\frac{5}{16}$ in. The circular or wave-



UTILITY PRESSURE AND VACUUM PUMP

Number of cylinders, 8; bore of cylinders, 1 in.; stroke, $1\frac{5}{16}$ in.; speed, 420 r.p.m.; capacity, 2.1 cu.ft. of free air per minute; lubrication, splash system; height over-all, 17 in.; width, 15 in.; depth, $9\frac{3}{8}$ in.; pressure pumped, up to 300 lb. per sq.in.; vacuums pumped, as high as $28\frac{1}{4}$ in. of mercury.

like motion of the rocker delivers the power in turn to each of the pistons, there being $\frac{1}{4}$-in. lead between the pistons which insures a continuous flow of air and a steady pull on the driving arm. The driving arm of the crankshaft is counterbalanced and a small blade attached to the crankshaft splashes oil on the various parts. One discharge valve is used for each cylinder and all of the eight are mounted in one plate. The valves are made of brass, cylindrical in shape, giving a soft face against a hard seat and are peened. An arrangement is incorporated to prevent rotation. It is stated that in operation the valves lift only about 0.01 in. off their seats, a feature that gives quiet running. The cylinders are cast en bloc and the intake is through a stationary port cut in each cylinder. The crankshaft, connecting-rod rocker, and pistons are of open-hearth steel, the first two being forged, heat-treated, and tempered. Each piston carries two cast-iron rings and is fitted with oil grooves. The crankshaft has a die-cast, nickel-bronze, removable bushing. The connecting-rods are $2\frac{1}{16}$ in. long and have a $\frac{3}{8}$-in. hardened-steel ball at each end. The motor furnished is either for alternating or direct current as desired and the

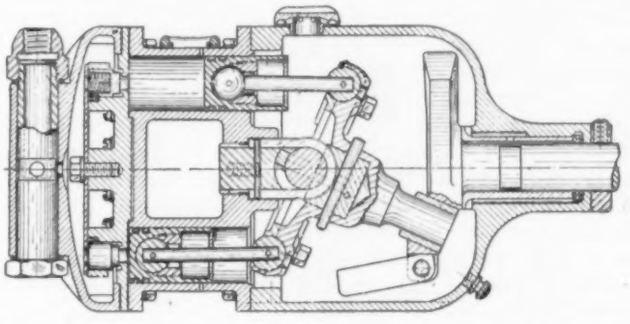
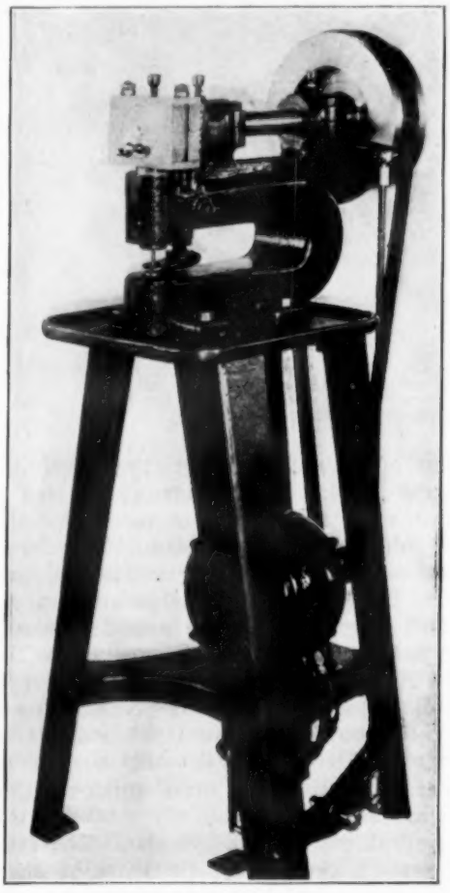


FIG. 2. A CROSS-SECTION SHOWING THE CONSTRUCTION

drive is by means of a silent chain protected by an aluminum chain guard. The capacity of the compressor is $2\frac{1}{10}$ cu.ft. of free air per min. and pressures up to 300 lb. or vacuums as high $28\frac{1}{2}$ in. of mercury.

Oliver Profiler

The profiler shown in the illustration is a recent product of the Oliver Instrument Co., Adrian, Mich., and is used for the production of duplicate irregular parts from sheet metal up to $\frac{5}{32}$ in. thick. The machine is built with a deep throat and a short stroke, the punch used being round in section, and having a heel

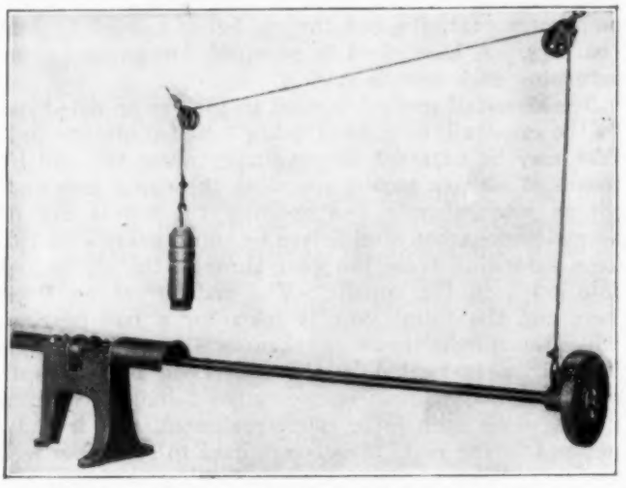


OLIVER PROFILER

on the back which does not raise out of the die when the machine is in operation. There is an eccentric bearing on the head by means of which the punch can be raised $\frac{3}{8}$ in. in order that the work may be passed under the punch when it is desired to work out a hole in a piece of metal. A templet is first made to the exact shape of the part desired, this templet being doweled to the work. The stroke is proportioned so that the punch clears the stock only and cuts into the metal until the templet rubs against the body of the punch; the work being guided by hand. It is impossible to over-run the finished outline, and the work comes from the machine practically finished, it being simply necessary to remove with a file any small scallops left by the punch. The machine is motor driven and has an interlocking switch and brake arrangement so that the machine only runs as long as the foot pedal is depressed. The speed is 250 strokes per minute and the stroke $\frac{1}{4}$ in. The total weight is 601 lb.

Grand Rapids Casting Grinding Machine

The Grand Rapids Grinding Machine Co., Grand Rapids, Mich., has recently placed on the market the casting grinding machine shown in the illustration. This machine is intended for use in the foundry or machine shop for the grinding of gates, sprues, fins, rough places, etc. or for the grinding of the surface of castings preparatory to filling and painting. The base casting has three feet in order that it may be mounted on rough flooring, and carries the main spindle in ring oiled bearings. The spindle is of the hollow type in



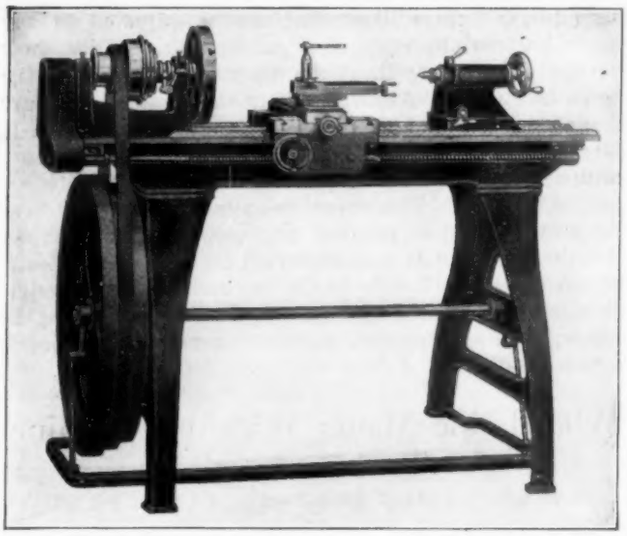
GRAND RAPIDS CASTING GRINDING MACHINE

the form of a heavy steel sleeve. The key extends through from the pulley into a long feathered keyway on the internal shaft which slides longitudinally inside of this hollow spindle. To the outer end of this spindle shaft is fitted a universal joint and to this joint in turn is fastened the long rigid shaft which carries the grinding wheel. This construction allows the grinding wheel to be moved up and down or sideways, and also in and out to a given extent, thus covering considerable area without the necessity for moving the casting.

The machine regularly carries a 12-in. grinding wheel with $1\frac{1}{2}$-in. face, but smaller wheels can be quickly fitted. The machine is driven by a 3-in. double belt and from 5 to 10 hp. are recommended. The wheel shaft is inclosed in a pipe the entire length and the wheel itself is provided with a guard. Standard equipment includes the machine complete with countershaft, counterweight, $\frac{3}{8}$-in. steel rope for counterweight, swivelsheave pulleys, clamps for rope, wheel guard, etc., but does not include the belting, grinding wheel or casting carrier which can be supplied as extras.

"Sterling" Foot-Power Lathe

The Shepard Lathe Co., Canal and Jackson Sts., Cincinnati, Ohio, has just placed on the market the "Sterling" 11-in., cone-head, back-geared, screw-cutting, foot-power lathe shown in the illustration. The lathe can also be furnished with countershaft for power drive if desired. The headstock is provided with a hollow spindle of high-carbon steel, running in white-bronze bearings, the front bearing being tapered to allow adjustment for wear. The cone pulley is three-step for a $1\frac{1}{2}$-in. belt. The back gearing is of the



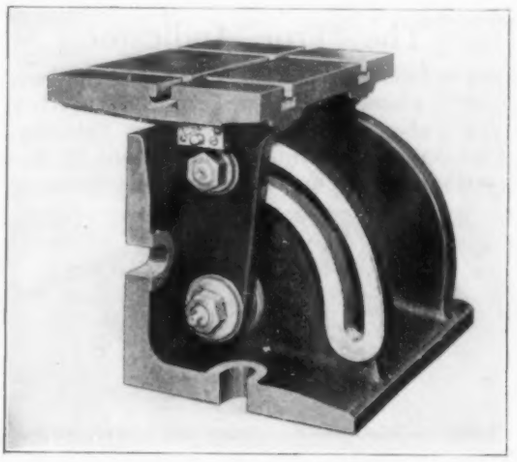
"STERLING" 11-IN. FOOT-POWER ENGINE LATHE

Actual swing over bed, 11¼ in.; hole through spindle, ½ in.; spindle nose, 1⅛ in. in diameter threaded, 19 pitch; front spindle bearing, 1⅛ x 2¼ in.; rear spindle bearing, 1¼ x 2¼ in.; diameters of cone pulley, 3, 4⅜ and 6½ in.; width of belt, 1¾ in.; ratio of back gears, 4 to 1, diameter of tail spindle, 1¼ in., diameter of lead screw, ⅜ in.; length of carriage on bed, 11 in.; size of tools, ⅜ x 1 in.; threads cut, 3 to 40; distance between centers, 24 and 36 in. with 4- and 5-ft. beds respectively; net weight, 500 lb.

planetary type and is located on the inside of the cone pulley. This construction allows the spindle to be thrown in direct or back gear without stopping the spindle, the movement being accomplished by means of the clutch handle located near the front spindle bearing. Either a compound or a plain rest may be furnished at the option of the purchaser, all rests being gibbed throughout and provided with micrometer collars on the feed wheels. The tailstock is of the set-over type for taper turning, the spindle being 1¼ in. in diameter, and graduated in sixteenths of an inch for drilling to a given depth. Power longitudinal feed is furnished as standard equipment and power crossfeed can be furnished at a slight additional cost. A chasing dial is arranged in connection with the apron handwheel to simplify the chasing of threads. A notable feature is that the bar foot treadle runs the whole length of the lathe, enabling the operator to drive the lathe from any point along the bed.

Taft-Peirce Toolmaker's Knee

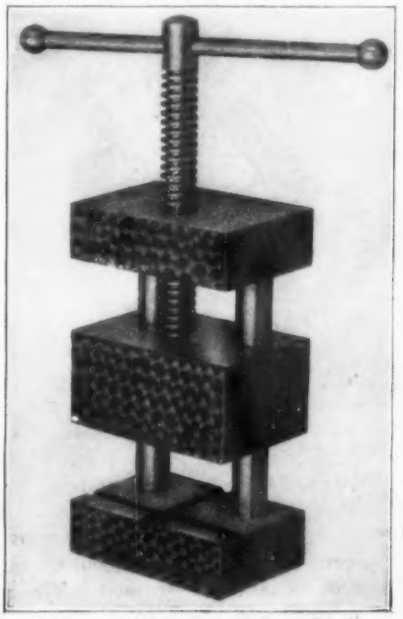
The illustration shows an improved form of toolmaker's knee recently placed on the market by the Taft-Peirce Manufacturing Co., Woonsocket, R. I. In the new device a second measuring plug has been substituted for the hole in the table, the distance between the two measuring plugs being 5 in. This arrangement facilitates the manipulation of the tool when making accurate measurements and also reduces the calculation necessary to set for any given angle. The outer measuring plug, instead of being inserted in the edge of the table, is mounted in an adjustable plate held in position by two dowel pins. This construction is used so that in case it is ever necessary to repair the knee the plate can be readjusted and redoweled without undue trouble. The base of the knee is finished on two right-angle faces which permit it to be set at any angle from zero to 90 deg. and yet make the measurement on an angle of 45 deg. or less, which gives the greatest degree of accuracy in observation. Another feature of the knee is the location of one of the measuring plugs in the center of rotation, this feature eliminating considerable measuring, as it does not change its position when setting the table. Both measuring plugs are protected from damage by parts of the knee which extend beyond them. The knee is also made with a vernier reading angles of 5 min. in place of the measuring plugs if desired.



TAFT-PEIRCE TOOLMAKER'S KNEE

Acme Drilling Vise

The Acme Tool Co., 143 West Water St., Milwaukee, Wis., has recently placed on the market the drilling vise shown in the illustration. This device is of open-work construction so that holes may be drilled completely through a piece of work, and two V-grooves are placed in one of the jaws so that cylindrical work can be conveniently held. The tool is made of semi-steel and the sides and edges are made at right angles so that after a piece of work is once clamped holes can be conveniently drilled at right angles without moving the work in the vise. The screw is 1 in. in diameter with an Acme

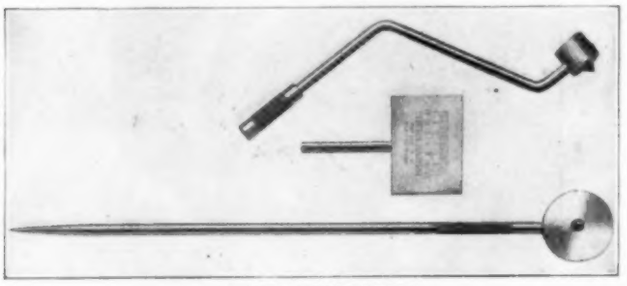


ACME DRILLING VISE

thread. The vise is 5½ in. wide, 3¾ in. high and 10½ in. long, having a maximum opening between the jaws of 4½ in. The sliding jaw moves on two cylindrical ways that are securely fastened at the ends to the stationary jaw and the block carrying the screw, these ways being of suitable size to give rigidity.

The "True" Indicator

Osberg & Johanson, 206 Boston St., Dorchester, Mass., has recently placed on the market the "True" indicator, or wiggler, shown in the illustration. This device requires no elaborate setting up on account of its simple construction, and has no delicate springs, levers or other

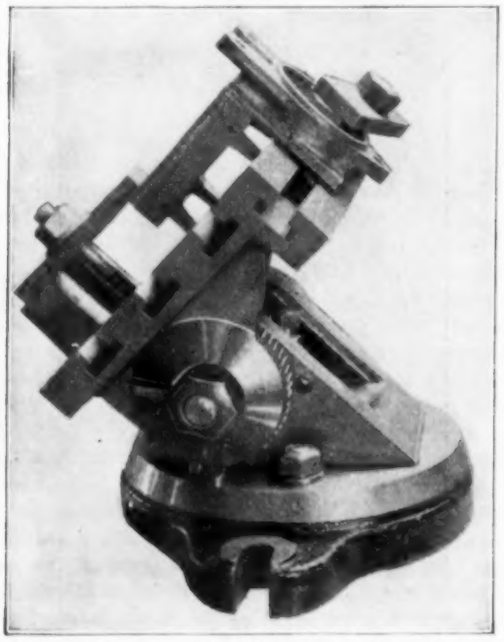


"TRUE" INDICATOR

small parts to get out of order. The outfit consists of a set of two centers and a scale that can be used for indicating motions of the pointer; this scale being held in an ordinary surface gage when in use. The device can be used for truing up center marks in work to be bored out, for testing lathe centers, aligning the headstocks and tailstocks of lathes, and other similar center jobs.

Nelson Universal Angle Fixture

The universal angle fixture illustrated is a recent product of the Nelson Tool and Machine Co., 253 Norfolk St., Newark, N. J., and is made in three sizes. The smallest size, 3 x 3¾ in., is made with a plain base only, while the two larger sizes, 6 x 9 and 9 x 12 in., are made with either plain or swivel bases as desired. The



NELSON UNIVERSAL ANGLE FIXTURE

swivel-base fixture illustrated can be adjusted to any angle horizontally and can be adjusted to 90 deg. in a vertical direction without the necessity of resetting the work being held. Adjustments in the vertical plane are made by a gear and pinion wrench that has a sufficiently large ratio to permit fine adjustment. After being adjusted to the desired position the table can be securely clamped. The swivel head is locked to the base by two bolts that prevent any possibility of lifting. Another feature is the construction of the top plate, which has three T-slots in the top and one on the edge, this being said to be advantageous where work of L-shape, such as the work shown clamped in position, is being handled.

What Is the Matter With the Machine-Tool Business?

BY W. D. FORBES

The growl of Entropy, made manifest on page 645 of *American Machinist*, is deserving of comment.

It may be divided into four parts: First, the query as to why men go into the machine-tool business, and once in, how do they stay in? second, his implication that all buyers of machine tools are bone-heads; third, that machine-tool builders are a timid, non-progressive lot, and fourth, that it is time to find some new expressions to use when selling tools.

Let us consider these statements in order: Men go into the machine-tool business because it can be made to pay, and they stay in it because it does pay. This is proven by the fact that the advertising pages of *American Machinist* carry the names of many tool builders, not a few of them having been represented there throughout the already long life of that estimable journal. If the business did not pay, these names would have dropped out of sight long ago.

I have personally assisted at the founding of several tool-building firms that have made money after the second year and are now rated high in the business world even though they have never done anything but build and sell machine tools. I have known, too, of a lot of people who have started in this line of business and failed; but such a condition will be found in all classes of trade.

Regarding the allegation that forms the second part of Entropy's disquisition: I have sold machine tools to many persons and firms and as a rule I have not found them bone-heads. I have often found that a buyer did not agree with me as to the value and utility of a tool and have sometimes been brought to change my views to accord with his, but have more often been able to convert him to my way of thinking. I have sold tools to people who would have liked to buy lathes and planers of a higher grade than those that I sold them, but lack of funds made it simply a question of buying what they could pay for or go without.

Most tool buyers want to get the best there is and all of them want to be shown why it is best; they will not pay for it unless its ability to do what is claimed for it is demonstrated. Often a customer will send me a blueprint of a piece which is now being machined on a certain tool in so many hours with speeds, feeds, etc., designated, and ask me if I know of any machine which will do better; if I do, I can make a sale. When a customer wants a standard tool he usually orders direct from the maker.

The foregoing would seem to indicate that Entropy's idea of the bone-head buyer is not substantiated, at least in so far as my customers are concerned.

Now about timidity and lack of progress: His reference to a designer from the back-hills but thinly veils the remarkable achievement of Mr. Harkness—the flat-turret lathe, a monument to him far greater than any of hewn stone or beaten brass—to whom the mechanical world owes much for his successful endeavor to overcome timidity in machine design.

Fellows, too, from the backwoods of Vermont, brought forth something in the way of gear-making machinery that can scarcely be called unprogressive; some years ago a man named Fox produced a lathe that was a departure from fixed ideas; the Lo-Swing lathe might be considered as a show of boldness, and Gisholt also has done some things other than change the size of oil-cups on his product.

Then we have the geared-head lathe, and the draw-in chuck for large sizes. The little box of quick-shift gears does not seem to please Entropy; neither did it please me at first, but I was soon converted and this is how it came about:

I had bought four small non-screw-cutting lathes, having a lot of work just suited to their capacity, but my foreman never ceased to growl and mutter about them, as he seemed to find jobs for them that required the cutting of threads.

One day he got a better job and I put one of the toolmakers in his place. Not hearing any growls from the new incumbent I went out into the shop to investigate and found these lathes being worked to the limit of their capacity on straight valve-stems which had three shoulders of different diameters to be threaded.

New Foreman Has Better Way

My new foreman had arranged to pass these pieces on, as soon as they were ready for threading, to a lathe which was equipped with the quick-shift gear, and each stem was finished at one dogging so far as the threads were concerned. The machinist cut the smallest thread first, changed the gears to the required pitch for the second size and dropped a proper-sized spacing block back of the stop-screw, changing again and substituting a larger spacing block for the largest thread. These shifts took but a moment each and thus served to give maximum of output with the least possible loss of time.

The quick-shift gear box is more than a talking point. As to scraped fits, ground spindles, and other talk considered by Entropy to be thread-bare, he should remember that to many others it is new; that there is a prospective machinist born every hour, who has to learn the value of these fine points. A good salesman talks to the man to whom he wishes to make a sale according to the latter's years and experience, and the observant seller soon knows what points will be most interesting to the prospective buyer.

The two-chuck and two-table idea for planing machines did not work out well because nothing was saved by it. In lathe work two chucks are handy only when a job comes along that must be done at once and the only available lathe is one in which a piece of work is already chucked that could not be re-set.

Taking it altogether it seems to me that we have advanced to a considerable degree in tool design since the civil war, and to my mind the 100 per cent. gain in machine work lies rather in the direction of trying to handle efficiently the tools which we now have rather than in searching for radical improvements.

A Universal Drill Jig Operated by Compressed Air

By Raymond Grant

The idea of a drilling jig that should be adaptable to different jobs by making for each job a pair of false jaws that could be used in the jig, I first worked out by a fixture in which the upper false jaw served as a guide bushing for the drill helping to locate the work, while the lower jaw was worked out to suit the job in hand and was raised by a lever-operated cam to clamp the work up against the upper jaw while drilling. The work to be drilled consisted mainly of small brass parts requiring one or more holes to be drilled with a considerable degree of accuracy.

In a later development the lower jaw was actuated by a foot pedal, leaving one hand free to put work into the jig and the other to feed the drill. This latter form worked so successfully both in respect to accuracy of product and speed of operation that I decided to substitute an air cylinder for the foot pedal, thus relieving the operator from the strain of holding the work under pressure while drilling. A double-acting air cylinder was placed on a bracket below the table of the drilling machine, and by means of a suitable coupling the fixture could be taken from the machine when not needed without disconnecting the air pipes. The plunger that carries the lower jaw and the bushing in which it slides were of tool steel, hardened, ground and lapped.

The exhaust air from the cylinder was piped up to where it could help blow the chips away, and an additional jet was provided which on most jobs would blow the work out of lower jaw as soon as it was released. Sheet-iron hoppers and spouts were provided to catch and convey the work to a box on the floor. These fixtures proved entirely satisfactory, being very rapid in action, and were steady producers. They were used on Henry & Wright machines, but can easily be adapted to any similar machine.

In pre-war days the prices on work up to about $\frac{5}{8}$ in. in diameter with drills up to $\frac{1}{4}$ in. in diameter averaged about 4c. a gross, with an occasional exceptional job as low as 2c. a gross and others as high as 8 or 10c.

I believe that there is no cheaper or more rapid way than this of doing this class of work and it would seem that the principle might be applicable to other classes of work.

Milling Cutter for a Thread Tool

By John H. Blackman

On page 419 of the *American Machinist* is an article describing a thread tool made out of a milling cutter. As the correct width of a cutter for square threads is measured on a line parallel to the length of the work, it will be seen that the space between threads is not the same for single as for double threads and that it also varies for different diameters. It would seem that a cutter like the one described for square threads would be right only for some certain size work.

Sparks from the

American Tools Wanted In England

Captain Taylor of England Speaking at Convention in Atlantic City Said American Machine Tools Stand in Great Favor

Capt. William T. Taylor, M. A. Soc. M. E., who is in this country on behalf of the Lord Roberts Memorial Workshops, gave a talk at the convention of the National Machine Tool Builders' Association held at Atlantic City, in which he illustrated the scheme of the organization and its manner of training and employing the British disabled soldiers and sailors.

Captain Taylor volunteered to tour this country at his own expense for the object of calling on American machine-tool manufacturers, requesting them to donate machine tools for workshops being put up in Ireland, Scotland, England and Wales by the Lord Roberts Memorial Workshops organization. It is gratifying to know that American machine-tool builders have taken a keen interest in the mission of Captain Taylor and at the convention the membership unanimously approved of immediate action with the result that a committee was formed.

American workers had a big share in the wide machine-tool market in Great Britain during the time of the war. This was well brought out by Captain Taylor who said that American machine tools stand in great favor; in fact, his object in coming to this country for machine tools of American make and design is ample proof of his own experience that they are the most efficient and at the same time the lightest and the most easily handled by disabled men.

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Convention of Marine Draftsmen To Be Held in Boston

The eighth annual convention of the American Society of Marine Draftsmen will be held at the Hotel Brunswick, Boston, Mass., on June 20 and 21. Arrangements for the convention are in the hands of the Boston branch of the Society and a most enjoyable time is assured the delegates and members of the various branches of the Society.

Organized at Philadelphia on Dec. 2-4, 1912, this Society has had a rapid and successful growth and branches are now located at all the prominent shipyards and navy yards throughout the country. It is the only strictly marine draftsmen's organization in the United States and has filled a most needed want for the members of this profession.

The object of the Society, as stated in its constitution, is to unite the marine draftsmen of the United States; to promote their general welfare professionally, intellectually and socially, and to cultivate the highest standard of professional ethics among them. The journal of the Society, which is published quarterly, is noted for its papers on naval architecture, marine engineering and allied subjects. The Society has now in course of preparation a marine draftsmen's handbook which will be of great value to marine draftsmen and others engaged in the great shipbuilding industry.

The present officers of the Society are as follows: President, Alfred H. Haag, chief naval architect, U. S. Shipping Board, Philadelphia, Penn.; vice president, W. A. Leavitt, Jr., New York Shipbuilding Corp., Camden, N. J.; secretary, B. G. Barnes, Lake Torpedo Boat Co., Bridgeport, Conn.; treasurer, J. Binford Sadler, industrial department, U. S. Navy Yard, Norfolk, Va.; executive committeemen, G. W. Nusbaum, U. S. Naval Gun Factory, Washington, D. C.; E. H. Monroe, bureau of construction and repair, Navy Department, Washington, D. C., and J. A. Kelley, consulting naval architect, New York City.

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E. A. Suverkrop Resigns from the Editorial Staff of the American Machinist

It is with genuine regret that we record the resignation of E. A. Suverkrop from our editorial staff, but his many friends will be glad to learn that he leaves to go into a line of work in which he has been deeply interested for many years, the production of gages of extreme accuracy.

It is probably safe to say that few editors have had the wide and varied experience from which to draw, both for writing articles and for assisting readers to solve their mechanical difficulties. Born in this country but educated on the other side of the water, serving an apprenticeship with a well-known Scottish firm of general engineers and founders and afterward sailing the seven seas in various engineering capacities, Mr. Suverkrop accumulated a remarkable fund of information which he is always willing to impart to anyone who may benefit by it.

Even before his connection with the *American Machinist*, which dates from Apr. 11, 1904, he made many friends by his articles, humorous and otherwise, under his own name as well as under the pen name of E. A. Dixie.

His work since his association with the paper speaks for itself and needs no comment. His many friends, both in and out of this organization, wish him the success which he so well deserves.

General Goethals Receives John Fritz Medal

On May 22, Maj.-Gen. George W. Goethals was presented with the John Fritz medal by the representatives of the four national societies of mechanical, electrical, civil and mining engineers; the medal being presented in honor of the work accomplished by General Goethals in building the Panama Canal. This medal was established in 1912 and is awarded not oftener than once a year for notable achievement along engineering lines. W. L. Saunders, past president of the American Institute of Mining and Metallurgical Engineers, made the presentation speech and General Goethals after receiving the medal made a brief response. Other speakers of the evening were Henry L. Stimson ex-Secretary of War; Col. G. J. Fieberger, professor of engineering at West Point, and Ambrose Swasey, past president of the American Society of Mechanical Engineers.

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Consulting and Advisory Service For Oil Men

The Wayne Oil Tank and Pump Co., Fort Wayne, Ind., has recently inaugurated a new consulting and advisory service for oil men.

This company has secured the services of F. A. Bean, consulting engineer, to take charge of this work. Mr. Bean's engineering experience covers a period of 23 years.

Mr. Bean first became affiliated with the oil industry in 1902 in the Kentucky and Oklahoma fields. For the past year and a half he has been at the head of the maintenance and equipment department of the Sinclair Refining Co., and also had charge of the designing and construction of their sales branches and filling stations. He has also been closely associated with the automobile industry.

There is to be no charge connected with the service of this department. All advice, plans, etc., are to be given gratis.

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Electrical Society Elects Officers

The anual meeting of the Society for Electrical Development was held at the Society offices in the Engineering Societies Building, New York City, Tuesday, May 13. J. Robert Crouse, vice president of the Society presided at the meeting. Members of the board of directors were elected as follows: Representing manufacturers, W. D. Steel, four years; representing jobbers, E. C. Graham, four years; representing contractors, James R. Strong, four years; Fred. B. Adam, two years; director at large, Charles W. Price, two years.

World's Industrial Forge

By E.C.Porter, News Editor

Westinghouse Courses for Technical Graduates

The success of the army system of training technical men for positions requiring a high degree of specialization has attracted much attention. However, the methods used are not altogether new, as many of them have been used for a number of years by the Westinghouse Electric and Manufacturing Co. in training college graduates for its commercial and engineering departments. Briefly, the principles involved are the careful selection of well qualified men for definite positions and the training by intensive methods for such predetermined positions.

Selecting the Men

Emphasis is laid on the selection of men with the proper characteristics for the line of work they desire. Indication of these qualities is found in the college work and other miscellaneous activities of the technical graduate. For some types of work certain characteristics must predominate, and for others these particular charactertistics are not so important. Personality, courage, tact and initiative are emphasized in the sales type of student. Mathematical ability, accuracy and analytical inclination indicate the engineering type. The basic qualities of character are considered rather than experience or skill. One point on which stress is laid is the necessity of an early determination of the kind of work desired, as a means of avoiding waste of time and in order to get the proper preparation for the ultimate position.

Specific intensive training is given for commercial, design, manufacturing and application engineering. The student is segregated for some particular branch as soon as he demonstrates his fitness and expresses a desire for this particular work. The radical difference in the experience afforded in the various shop sections, as well as the limited time available for each student, makes early segregation necessary. For instance, it is useless to have a graduate working on heating equipment or overhead line material when he is scheduled for sales in the marine machinery department.

Course Covers Twelve Months

The course covers a period of approximately twelve months divided into shop experience and intensive study. During the first period of the course short assignments in different manufacturing sections bearing a definite relation to the position in which the man will ultimately be placed are taken up. Weekly class conferences accompany this shop period to insure thoroughness in the shop's experience, to give a knowledge of the developments of the immediate work in which the men are engaged and to study the features of the company's product as a whole.

An Intensive Study Period

This shop training is followed by a short period of full-time intensive study adapting the student to his particular permanent work. This is conducted under the immediate supervision of the department heads. For instance, students training for work in the engineering departments spend the last three months of their course studying the salient features of Westinghouse design under the leadership of the chief engineer. Likewise the commercial students pass through a period of intensive study of business methods, advertising and the construction of Westinghouse apparatus from the selling point of view.

After completion of the intensive study period, the student is taken into the regular organization of the company in the department for which his entire training has been shaped to prepare him. The departmental requirements are known some time in advance and the number of men appointed to the course is carefully restricted to limits based on these requirements. The method of training more men than are needed has been found unsatisfactory. Every man now appointed to the course is selected and trained for some definite position. Quite a number of men are taken for training as managing operators for public-utility corporations. Men are chosen not so much because they express a desire for a particular phase of work, but because they show training and ability of a higher capacity than the average.

A Basis for Cultivation

The opportunities for work on problems of practical engineering application and commercial importance and of association with men of broad business and engineering experience give the student a basis for cultivation of whatever latent or active ability he may have. Continued contact with high standards in engineering ethics and business practice rarely fails to produce a favorable reaction. The preparation of these young men for positions of responsibility is a matter of vital importance to the company, dealing as it does with the man material for the future operation of the organization. The eminently successful system of "promotion from the ranks" to the higher positions makes it doubly important that the company and the young engineer each recognize the potentialities of the other and avail themselves of these opportunities.

The National Association of Manufacturers Meet

President of Association Delivers Address Followed by Reports of Officers and Election of Other Officers

The twenty-fourth annual meeting of the National Association of Manufacturers was held at the Hotel Waldorf-Astoria, New York City, May 19 to 21, 1919. The opening day was devoted to the appointment of committees and to the reception of reports from the various standing committees of the Association.

Stephen C. Mason, president of the Association, delivered his address on the second day. This was followed by reports of general officers and the following addresses: "Federal Revenue and Tax Legislation," by Hon. Daniel C. Roper, Commissioner of Internal Revenue; "Federal Promotion of Vocational Training," by Herbert E. Miles, director of division of training, United States Department of Labor and chairman of the National Association of Manufacturers' committee on industrial education; "The Banker and the Manufacturer," by Ferdinand C. Schwedtman, vice president, National City Bank, and chairman of the committee on banking of manufacturers; "The Metric System in Export Trade," by Frederick A. Walsey, commissioner, American Institute of Weights and Measures, New York City.

The evening of the second day was devoted to the export-trade session. On the third day the reading of papers proceeded as follows: "The Status of Informal War Contracts," by Hon. G. H. Dorr, assistant director of munitions, War Department; "Engineering and Standardization Branch, War Department—Its Present and Possible Relation to Manufacturers," by Charles V. Bacon, chief of engineering and standardization branch, general staff, the War Department; "Approaching Changes in American Patent Laws," by Edwin J. P. Pruidle, counselor at law, New York City.

At the conclusion of this session the regular elections of vice presidents and directors-at-large took place. The regular annual banquet was held on the evening of the final day in the grand ballroom of the Waldorf-Astoria Hotel.

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New Shipbuilding Record

Two hundred and one vessels registering 375,605 gross tons, of which 75 ships with 316,177 gross tons were seagoing steel vessels, 30 with 52,097 tons were wooden ships for sea service, and 105 with 368,274 tons were non-seagoing vessels, was the new record for the American shipyards during April, 1919.

Business Items

The National Bank of Commerce of New York has opened an office in London, located at 17 Shorborne Lane, King William St. Kenneth H. Rockey is in charge.

At a recent meeting of the directors of the American Welding Society, J. H. Deppeler of the Metal and Thermit Corporation, Jersey City, N. J., was elected a director of the society.

The Fulflo Pump Co. announces the opening of a Chicago office, which will be in charge of R. E. Manly, of the Manly Sales Co., located at 6253 Ellis Ave., Chicago, Ill. A complete stock of the company's products will be maintained, including all standard pumps for machine tools, grinding machines, circulating baths, etc.

The American Bureau of Welding held a meeting on Apr. 11 at the Engineering Societies' Building, 33 West 39th St., N. Y., to elect its officers. The following were elected: C. A. Adams, director; H. M. Hobart, vice director; A. S. Kinsey, vice director; W. E. Symons, treasurer; H. C. Forbes, secretary. Regular meetings of the Bureau are to be held on the third Friday of each month.

H. W. Butler of Cravon House, Kingsway, London, England, is staying at the Manhattan Hotel, 42nd St., New York City, and will be glad to hear from manufacturers of small electrical tools, fractional horsepower motors, varnished fabric, paper, insulating materials, etc., with the view of development of trade in European markets. Mr. Butler is well known in English trade circles, having been chairman of the British Electrical Manufacturers Association for two years, from 1910-12, and also chairman of the organizing committee of the last Electrical Exhibition held in England in 1911.

The Solar Metal Products Co., Inc., Columbus, Ohio, announces the following changes in its organization: G. R. Le Sauvage was elected president on Jan. 2, 1919, and on his release from active duty as Senior Lieutenant in the U. S. Naval Reserve Force assumed the duties of general manager, succeeding H. R. Gogay, formerly the vice president, treasurer and general manager, who resigned on Mar. 30, 1919. E. C. Camp has been elected assistant treasurer, assistant to the president, and continues his work as sales manager in charge of sales and advertising. A. C. Rollins has been elected treasurer in charge of accounts and credits. E. C. Probst has been appointed purchasing agent and chief of order and service departments. A. Miller has been appointed works manager. H. C. Miller has been appointed superintendent of the paint-enameling department.

The stockholders of the Joseph Dixon Crucible Co. held their annual and regular meetings on Monday, Apr. 21. The following directors and officers were elected: Directors, George T. Smith, George E. Long, William G. Bumsted, Edward L. Young, J. H. Schermerhorn, Harry Dailey and Robt. E. Jennings; officers, George T. Smith, president; George E. Long, vice president; J. H. Schermerhorn, vice president; Harry Dailey, secretary; William Koester, treasurer; Albert Norris, assistant secretary and assistant treasurer. The American Graphite Co., incorporated under the laws of the State of New York, is a subsidiary of the Joseph Dixon Crucible Co., and its annual election was held on the same day as that of the Joseph Dixon Crucible Co., and resulted in the election of the following officers: George T. Smith, president; George E. Long, vice president; J. H. Schermerhorn, treasurer; Harry Dailey, secretary; William Koester, assistant secretary and assistant treasurer. The directorate is the same as that of the Joseph Dixon Crucible Co.

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Trade Currents

Cleveland Letter

While the market for machinery and machine tools in the Cleveland and northern Ohio district is still spotty, as the month advances it is easily seen that there is a slow, but steady improvement all around. The bulk of business still comes from the automobile industry in this section and those sections of the automobile trade served by certain firms in this locality. Forging and metal-working machinery demand is nearly normal, according to leading manufacturers and distributors of this class of equipment. Plumbing lines, presumably influenced by the prospects for larger building activities hereabouts, are taking larger quantities of smaller equipment. There is a lot more small material and equipment for general purposes being absorbed than was the case six weeks ago.

Large individual orders are not quite so frequent as would be expected under normal conditions, but a significant indication is the order now pending in this market from the Central Steel Co., Massillon, Ohio, which qauntity will probably aggregate $50,000. Lathes, boring machines and a miscellaneous assortment of smaller equipment will be included in the order, it is reported locally.

One influence upon stimulation of business is the assurance by the trade as a whole to consumers that prices will not be any lower. It seems that many consuming establishments have been waiting on such a contingency, and as it has not developed, are more liberal with their inquiries. Most of the inquiries being received here in the past week or so are generally for materials that can be furnished quickly by local manufacturers or distributors.

It is the opinion of leaders in the machinery industry here that as soon as definite disposition of Government-owned machinery is made, a speedy return to normal conditions all around will be seen.

Personals

L. M. MANLEY, for the last two years employed as chief of switchboard, wood and iron work section, planing division of the Western Electric Co., Chicago, Ill., has taken a position on the editorial staff of the *American Machinist*. Mr. Manley, prior to his connection with the Western Electric Co., was supervisor of engineering shops in the Western State Normal College, Kalamazoo, Mich., and has had wide mechanical and engineering experience.

CAPT. BEN SLOAN, who served in the Ordnance Department, U. S. A., for two years, has been discharged and is now connected with the New York sales office of the Pratt & Whitney Co.

J. P. ALEXANDER, who has represented a number of departments of the General Electric Co., Schenectady, N. Y., in central New Jersey, is now connected with the power and mining department of this company, Equitable Building, 120 Broadway, New York.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Co., has been awarded the Edison medal by the American Institute of Electrical Engineers for "invention and development of electrical machinery."

MAJ. CHARLES E. CARPENTER, formerly general manager of the Allied Machinery Co., in Europe, and of the Quartermaster Department, A. E. F., has been awarded the ribbon of the Legion of Honor by the French Government.

M. H. JONES, who has been connected with the Westinghouse Electric and Manufacturing Co. for the last 15 years as assistant to manager of the Philadelphia district, has resigned his position with that company to become sales manager of the Standard Electric and Elevator Co., Baltimore, Md.

F. X. MEEHAN has been appointed advertising manager of the Walter A. Zelnicker Supply Co., St. Louis. He was formerly associated with Fairbanks, Morse & Co., A. T. & S. F. R.R. Co. Coast Lines, and the St. Louis smelting and refining works of the National Lead Co.

W. W. TARLETON has recently severed connections with the Southern Manganese Corporation, Anniston, Ala., to become purchasing agent and traffic manager for the Anniston Steel Co. Mr. Tarleton will be in charge of the sale of all equipment acquired by the steel company from the Illinois Car and Equipment Co.

HOMER L. FERGUSON, president and general manager of the Newport News Shipbuilding and Dry Dock Co., Newport News, Va., has been elected president of the Chamber of Commerce of the United States. This announcement was made recently at the offices of the

(*Continued on page* 1066*b*)